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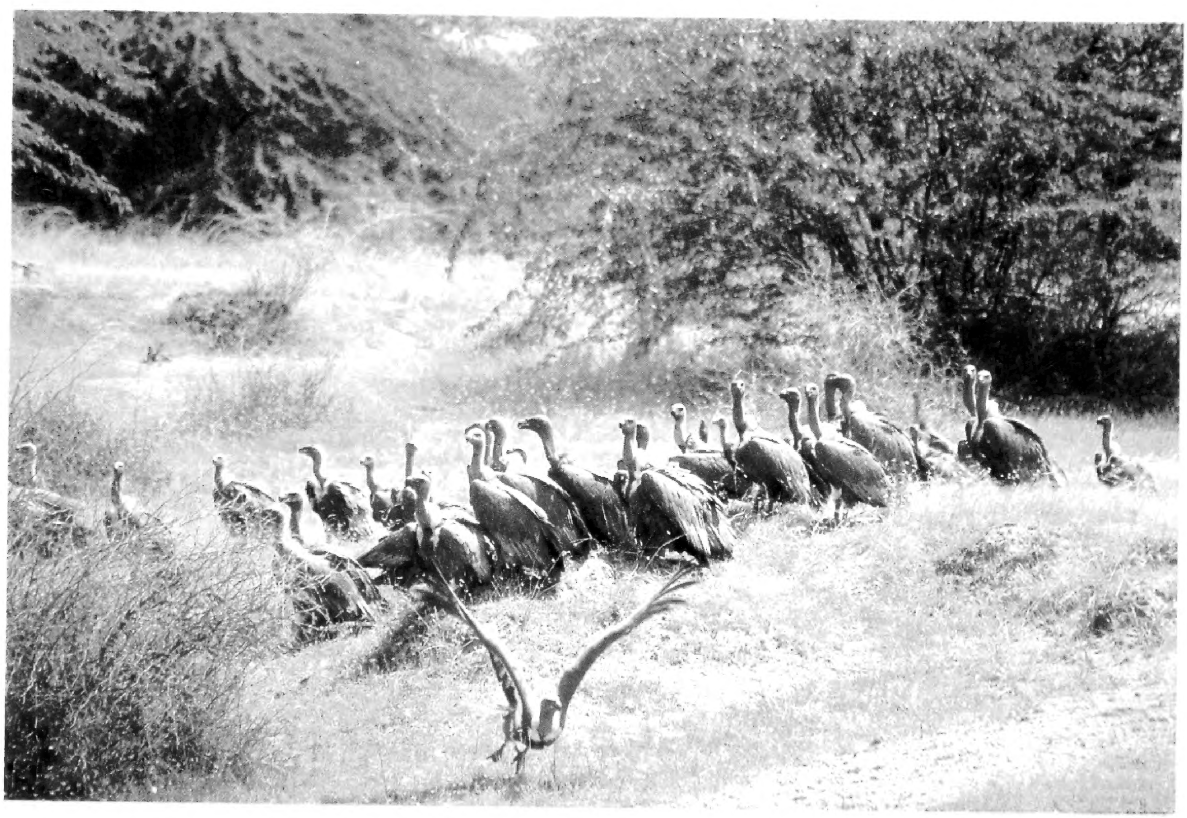
Report of the International South Asian Vulture Recovery Plan Workshop



Bombay Natural History Society

2004

Foreword

Perhaps no other bird species in the world have seen a more rapid decline than those of *Gyps* vultures in South Asia. Ever since this decline was first reported by me in a small article in the *Newsletter for Birdwatchers* (1998), and later confirmed by Vibhu Prakash from his scientific studies and extensive surveys (1999), the populations of the Oriental White-backed Vulture *Gyps bengalensis* and the Long-billed Vulture *Gyps indicus* have declined by at least 97% across northern India (Prakash *et al*. 2003). The recently described species, the Slender-billed Vulture *Gyps tenuirostris*, found only in a long and narrows belt north of the Ganga and parts of the northeast, is now perhaps the rarest vulture in the world. Similar rapid declines have been noticed in Pakistan (Oaks *et al*. 2004) and Nepal (Hem Sagar Baral, *pers. comm*., 2004).

Various theories were given to explain this decline – the most plausible was that the vultures are dying in large numbers due to a viral decline. However, the real breakthrough came in mid-2003, when J. L. Oaks and his team found that the recently introduced pain-killer, diclofenac, could be the main cause of these deaths. After further research, they published their findings in January 2004 in the highly respected Nature (Oaks *et al*. 2004), proving that residues of diclofenac in cattle carcasses is the main cause for population declines of vultures in Pakistan. Oaks *et al.* (2004) found that all birds collected dead with gout had diclofenac residues in their kidneys. None of the birds found without gout contained diclofenac. These results were supported by experimental evidence showing dose-dependent mortality in Oriental White-backed Vultures fed on the tissues of livestock treated with a normal veterinary dose of diclofenac shortly before death. Experimentally treated Oriental White-backed Vultures that died also exhibited visceral gout. Recently, Shultz *et al*. (2004) showed significant correlation between the presence of gout and contamination of kidney or liver tissues with diclofenac in a sample of dead and dying vultures collected across India and Nepal.

The recently published modeling study by Green *et al*. (2004) shows that less than 1% (between 0.13% and 0.75%) of ungulate carcasses available to vultures would need to have contained levels of diclofenac lethal to vultures, to have resulted in the observed rates of vulture decline. There are about 502 million ungulates in India and an estimated 5 million of them are given diclofenac injections annually. If we assume that 10-20% of ungulates (50-100 million), die per year then between 5% and 10% pf carcasses would be contaminated with high levels of diclofenac if death occurred soon after treatment in all cases. Of course, it is very unlikely that death occurs soon after treatment in every case. However, comparison of these figures with those from Green *et al*. (2004) shows that only a small proportion of treatments (between 1% and 15%) would have to be administered just before death to account for the vulture declines.

Like any other species, vultures also die of many other causes, sometimes man-made. Perhaps, some vultures were eliminated by airport authorities to prevent air strikes, but this would not explain the disappearance of millions of birds from the skies of north and northwest India. It would also not explain the death of chicks and fledglings in the nest, and disappearance of vultures from vast areas where no airfield is present.

The decline of *Gyps* species of vultures in the Indian subcontinent has alarmed the international community and has been reported all over the world. It has also brought international and national conservation organizations, and governments together to save these ‘lords of the sky’. I am happy to present the report of the International South Asian Vulture recovery Workshop, organized by the Bombay Natural History Society, Haryana forest Department, Royal Society for the Protection of Birds and other, in Parwanoo. Haryana, India from 12 to 14 February 2004. The participants of this workshop recommended that diclofenac should be banned from the veterinary use to save the vultures. As this will take some time, captive care and conservation breeding facilities should be started meanwhile in all the range countries (India, Nepal and Pakistan) to protect the remaining vultures. It will be a costly affair, but do we have a choice?

Asad R. Rahmani

Report of the international South Asian Vulture Recovery Plan Workshop

12-14 February 2004

Representatives of the following organisations have contributed to and endorsed this working document:

Ministry of Environment and Forests,
Central Government of India
Haryana State Forest Department
Himachal Pradesh State Forest Department
Assam State Forest Department
Gujarat State Forest Department
Wildlife Institute of India
Zoological Survey of India

IUCN Conservation Breeding Specialist Group
IUCN Reintroduction Specialist Group
Bird Conservation Nepal
BirdLife International
Bodega Bay Institute
Bombay Natural History Society
Disney Foundation
Israel Nature and Parks Authority
Ministry of Agriculture, Forests and Fisheries, Cambodia
National Birds of Prey Trust
Nature Conservation of Nashik
Ornithological Society of Pakistan
Royal Society for the Protection of Birds
The Peregrine Fund
Washington State University
Wildlife Conservation Society
Wildlife Trust of Bangladesh
Wildlife Trust of India
University of Glasgow
Zoological Society of London

The Following Summary and Recommendations Resulted from the International South Asian Vulture Recovery Plan Workshop, held in Parwanoo, India from 12-14 February, 2004.

Three species of vultures endemic to South Asia are in grave danger of global extincion.

Monitoring of populations of *Gyps bengalensis*, *G. indicus* and *G. tenuirostris* has revealed declines in excess of 97% over a 12 year period in India and 92% in a 5 year period in Pakistan. A rapid decline is also in progress in Nepal. Recent trends in other range states (mostly in South-East Asia) are less well-studied; populations there are low but declines are thought to have been historical and slower, rather than recent and rapid.

The vulture species at risk are found in Bangladesh, Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Pakistan and Vietnam.

Due to these declines, all three species were listed by IUCN - The World Conservation Union in 2000 as Critically Endangered, which is the highest category of endangerment. This assessment indicates a high risk of global extinction in the wild in the near future. Current captive populations are not viable for any of the species, so complete extinction is likely to occur if no action is taken.

All three species were continuing to decline at the time of the most recent surveys in India, Pakistan and Nepal (2003). Populations are now declining by more than 50% per year for some species and locations and the rate of decline has increased in recent years.

Surveys in India indicate that the rarest species, *G. tenuirostris*, currently has the highest rate of decline.

Vultures perform important functions in South Asian ecosystems and provide services to humans, such as the reduction of potential of health risks posed by decomposing livestock carcasses.

♦ **After a careful review of these facts, we urge all competent and responsible agencies, including national, state and provincial governments, national and international non-government organisations and agencies and local communities in all range states to take urgent action to avert the imminent threat of global extinction of the three vulture species.**

An international research effort involving many organisations has identified the most important causes of the population declines and recommended a programme of action.

Recently published research indicates that diclofenac (a non-steroidal anti-inflammatory drug) is a major cause of the observed rapid population declines. Exposure to diclofenac occurs through its use to treat symptoms of disease in domestic livestock. Experiments show that captive vultures are highly susceptible to diclofenac and are killed by kidney failure within a short time of feeding on the carcass of an animal treated with the normal veterinary dose.

Modelling shows that vulture declines at the observed rates can be caused by the contamination of less than 1% of livestock carcasses with levels of diclofenac lethal to vultures. The proportion of adult vultures which die with symptoms of diclofenac poisoning is consistent with that expected if diclofenac is the sole cause of the recent rapid population declines.

We recommend that government authorities in all range states begin action immediately to prevent all uses of diclofenac in veterinary applications that allow diclofenac to occur in the carcasses of domestic livestock available as food for vultures.

♦ **We recommend the use of the most expedient procedures appropriate to local circumstances to achieve this objective within five years. Legislation or implementation and enforcement of regulations to ban all veterinary uses of diclofenac that pose a risk to vultures are strongly recommended. The most effective mechanism may be an outright ban on veterinary use.**

♦ **We urge all competent organisations and agencies to implement programmes to raise awareness of the problem of diclofenac poisoning of vultures in the general public and especially in groups of interested parties, including farmers, graziers, veterinarians, pharmacists, staff of government and state wildlife and agricultural agencies and religious and other groups which place special value on the continued existence of vultures.**

♦ **We recommend that appropriate authorities undertake thorough evaluation of pharmaceuticals likely to be used in place of diclofenac to ensure that they are not also toxic to vultures and other scavengers.**

Although diclofenac has been identified as the major cause of the current vulture declines, scientific research in progress indicates the existence in vultures of a new virus strain in association with lesions of the nervous system. There is currently no evidence that this

virus causes the death of vultures or has significant effects at the population level. However, neither can the possibility of such effects be excluded.

♦ **We recommend that appropriate bodies continue to carry out and support scientific research to evaluate the potential influence of infectious disease on vulture populations.**

Some scientific studies of the causes of vulture population declines have been seriously impeded by the way in which legal regulations on the taking of dead vultures and collection and transportation of specimens have been implemented.

♦ **We urge the appropriate authorities to operate the systems they have to regulate the collection and transport of biological specimens from wild species in such a way as to facilitate research on the causes of vulture declines.**

Some environmental changes have produced adverse effects on vultures in parts of their range, or seem likely to do so in the future, even though they appear not to have made a significant contribution to the recent rapid declines within the core of the range. Some of these changes, such as food shortage caused by the burial or burning of carcasses to reduce the nuisance and health risks posed by decomposing livestock carcasses, have been triggered by the vulture decline itself. Others, such as the removal or disturbance of nest sites, deaths caused by exploitation for traditional medicines, recreational activities, the control of birdstrike hazards and the poisoning of vultures as a consequence of attempts to control carnivorous mammals are not thought to have made a significant contribution to the declines, but might prevent or delay recovery if they are not addressed.

♦ **We urge the appropriate authorities and agencies to carry out research and monitoring to assess the extent to which food shortage, and other factors not thought to have contributed significantly to the recent rapid population declines, might prevent or delay recovery or compromise the success of future re-introductions. Remedial actions should also be developed, where appropriate. However, it should be noted that although potentially important, these activities are less urgent than measures to counteract the causes of recent rapid declines.**

Monitoring of population size and trends and scientific research to identify causes of declines have been essential in detecting the crisis currently facing vulture populations in South Asia. For some parts of the range of the threatened vulture species there is insufficient information on population and threats. Furthermore, it is not yet clear whether or not additional species that occur in and adjacent to the range of the threatened species, *Gyps himalayensis* and *G. fulvus*, are also in decline.

♦ **We recommend that existing population monitoring programmes for the three threatened vulture species should be continued.**

♦ **Monitoring of populations and threats should be initiated or enhanced in Bangladesh, Bhutan, Cambodia, Myanmar, Laos PDR and Nepal.**

♦ **Urgent measures should be taken to investigate whether *Gyps himalayensis, G. fulvus* and other scavenging species are affected by similar factors to those that have caused the recent declines in resident South Asian *Gyps* species. If this proves to be the case, monitoring of these species should be improved.**

The recovery plan focussed upon principal causes of the recent catastrophic declines, and the activities required to counter them. After careful review, the meeting concluded that activities to counter these threats, and *in situ* management of wild vulture populations, are together unlikely to avert imminent extinction of vulture populations.

The participants agreed that immediate capture and holding of individuals of all three *Gyps* species is required urgently in order to avert their extinction. *Gyps tenuirostris* is most imminently threatened, with an unknown population size and range, with possibly only a few hundred pairs remaining in the wild.

♦ **We urge that captive populations of all three *Gyps* species are established immediately in South Asia. We recommend that as many vultures be taken into captivity during the 2004 breeding season as can be held in captive facilities, irrespective of location, provided that their health and welfare is not compromised.**

Vultures that are not taken into captivity are likely to be subject to a 30-60% risk of mortality within the next year. Capturing additional birds in subsequent seasons will be a continuing priority to meet captive management needs.

Ideally, vultures should be taken into captive centres within their recent or historical ranges according to IUCN guidelines. However, only one such centre currently exists in South Asia outside zoos; the vulture care centre in Haryana State, northern India.

♦ **We recommend that the Haryana centre, a collaborative venture between BNHS and the State Government of Haryana, should be expanded as rapidly as possible to hold more vultures in 2004.**

Any vultures that can be captured in 2004 but cannot be housed in South Asia should be taken for safekeeping and/or captive breeding to other suitable facilities outside their historical range. This should be with the intention of repatriation to holding or breeding programmes, or for release, into the country of origin or other parts of the species range if and when suitable facilities become available, or when the environment is free of diclofenac.

♦ **We recommend that all vultures taken and their progeny remain the property of the governments of the countries of origin.**

If moved to centres outside South Asia birds should preferentially be taken to countries within the range of *Gyps* species, or as close to their ranges as possible, to minimise disease risks in the holding countries or on reintroduction.

Opportunities should be sought to develop expertise and capacity in captive vulture management within South Asia, and to transfer this expertise to other parts of the region. The aid of agencies with appropriate expertise, irrespective of location, should be sought as a matter of urgency to expedite the development of facilities within South Asia.

♦ **A technical advisory committee on vulture captive management (TACVCM) should be convened, with expert membership from relevant organisations such as the IUCN CBSG and RSG, TPF, ZSL, NBPT, WCS, ERWDA, BNHS and technical members from range state organisations.**

♦ **Each holding and/or breeding centre should be visited annually by individuals from at least two TACVCM member organisations from countries outside the facility. These member organisations should report annually to the recovery plan secretariat (see below) at the annual plan review meeting on the progress, development and requirements of individual facilities.**

Whilst immediate removal of diclofenac from the vultures' environment in South Asia is an important aim, it is believed that complete removal is likely to take a number of years. Consequently, holding centres should be set up with the intention of captive breeding in the long-term should this prove necessary.

♦ **We recommend the rapid establishment of a minimum of three centres, each with the capacity for 25 pairs of each of the three species**.

This recovery plan aims to identify the measures necessary to avert vulture extinction; this necessarily includes activities that must be undertaken rapidly over the coming months and reviewed frequently. The plan also recognises that factors not responsible for the recent catastrophic declines may assume increasing significance in future as the already low populations fall still further. Both the urgent nature of the measures required, and predicted changes in the threats to vultures, necessitate regular review and revision of the recovery plan.

♦ **We recommend that annual review meetings be convened, for a minimum period of 5 years, to review new information, evaluate progress and revise recommendations and priorities. Attendance should be open to any individuals or agencies actively involved in the agreed recovery plan. Review meetings should be coordinated by a secretariat, preferably under the auspices of IUCN. Emergency meetings should be convened as necessary.**

Signatories to the workshop summary document on 14th February 2004

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1 INTRODUCTION

This report is the outcome of an international workshop held at Parwanoo, Himachal Pradesh, India on 12-14 February 2004. The workshop was funded under two grants from the Darwin Initiative and convened by Bombay Natural History Society and the Haryana State Government. Delegates to the workshop included government representatives, conservation scientists, pathologists, experts in the management of captive animals and their re-introduction to the wild and representatives of non-governmental organisations concerned with nature conservation. The objective of the workshop was to devise a plan of action to save three species of vultures resident in South Asia, *Gyps bengalensis*, *G. indicus* and *G. tenuirostris,* from global extinction and to restore populations in the wild over as much as possible of their recent geographical range. The workshop was a response to the catastrophic collapse of populations of the three vulture species during the past decade. The recovery plan also benefited from another international meeting; the Kathmandu Summit Meeting on the veterinary use of the drug diclofenac, held on 5-6 February 2004 at Kathmandu, Nepal and convened by The Peregrine Fund and Bird Conservation Nepal. In combination, the two meetings brought together interested parties from states comprising most of the geographical range of South Asian *Gyps* vultures (Cambodia, India, Pakistan and Nepal were represented). The Plan identifies the most likely causes of the recent declines, the main threats to vultures in the wild, now and in the future, and a programme of action designed to prevent extinction and remove the causes of endangerment from the environment. The programme identified in the Plan is long-term and is intended to be employed in a flexible and adaptive way. Recommendations are made for regular reviews of scientific evidence and progress with conservation action and for updating of the Plan.

2 Ecology of *gyps* vultures

Gyps vultures are large-bodied (5-10 kg) birds adapted for economical soaring flight in updraughts and thermals. They feed on tissues from carcasses of large mammals located from the air, either by seeing the carcass itself or the responses of other vultures to it. They eat meat, offal and intestines but not stomach contents and can take sufficient food into the crop at one meal to last several days. They form monogamous pairs in which the sexes share the incubation and care of the young. Nests are on trees or cliffs and are colonial in some species.

Of the eight species of *Gyps* vultures worldwide, four species are found only in Asia (oriental white-backed Vulture *G. bengalensis,* long-billed vulture *G. indicus,* Himalayan griffon *G. himalayensis,* slender-billed vulture *G. tenuirostris*), three are found exclusively in Africa (African White-backed vulture *G. africanus,* Cape griffon *G. coprotheres,* Rüppell's griffon *G. rueppellii*) and one breeds in Eurasia but migrates into Africa and south Asia (Eurasian griffon *G. fulvus*). Geographical ranges of all *Gyps* species overlap to some extent with those of others in the same genus (Pain *et al.* 2003). *Gyps* vultures are typically widespread and abundant, accounting for the majority of individual vulture sightings in both Africa (c. 90%) and Asia (c. 99%) (Houston 1983). Their abundance in India is explained by the availability as food of domestic cattle and buffalo carcasses that for religious reasons are usually not consumed as meat. In some ecosystems, *Gyps* vultures feed predominantly on the carcasses of wild rather than domestic ungulates. For example, in the Serengeti, Tanzania, high population densities of *Gyps* are present and consume more than a quarter of the available ungulate carcasses (Houston 1983).

All *Gyps* species range widely to forage (Houston 1974, 1983) and immature individuals disperse even more widely, and are more nomadic than adults. In some populations, *G. fulvus* juveniles appear to undergo large-scale annual migrations before settling into a resident breeding population (Susic 2000).

Gyps species are long-lived; the maximum-recorded life span of *G. fulvus* in captivity is 37 years (Newton 1979). They reach maturity at 4-6 years, and then produce one egg during each subsequent breeding season (Mendelssohn & Leshem 1983; Simmons 1986; del Hoyo *et al.* 1994). Annual survival rates of large raptors are typically high (around 0.95; Newton 1979). In stable or increasing populations of *Gyps* vultures, documented adult survival rates are high. For example, in an increasing, re-introduced *G. fulvus* population in France, adult survival was as high as 0.987 ± SE 0.006 (Sarrazin *et al.* 1994). The breeding success of *Gyps* vultures varies among species, areas and years, but is usually in the range 0.5 to 1.0 fledglings per pair per year. Hence, in a

stable population, only 10-20% of fledglings would be expected to survive to breeding age.

3 Review of population trends and conservation status of the endemic *gyps* vultures of South Asia

3.1 Summary of the conservation status of the endemic *Gyps* vultures of South Asia

Three species of vultures endemic to South Asia, oriental white-backed vulture *Gyps bengalensis*, long-billed vulture *G. indicus* and slender-billed vulture *G. tenuirostris*, are in danger of imminent extinction across most of their current geographical range. Population surveys have revealed declines of resident *Gyps* spp. vultures in excess of 97% over a 12-year period in India and 92% in a 3-year period in Pakistan. A rapid decline is also in progress in Nepal. Populations of *Gyps bengalensis* and *G. tenuirostris* in South-East Asia (Cambodia, India, Laos PDR, Myanmar, Nepal, Pakistan and Vietnam) are low but declines are thought to have been historical and slower, rather than recent and rapid. World population size is not known for any of these species.

Because of the evidence of widespread and rapid population decline, all three vulture species were listed by IUCN, The World Conservation Union, in 2000 as Critically Endangered (BirdLife 2000), which is the highest category of endangerment. This assessment indicates a high risk of global extinction in the wild in the near future. Current captive populations are not viable for any of the species, so complete extinction is likely to occur if no action is taken.

3.2 Magnitude, timing and geographical extent of recent population declines

3.2.1 South-east Asia

Until the middle of the 20th Century, *Gyps bengalensis* and *Gyps indicus/tenuirostris* were abundant across much of tropical Asia. Slender-billed and white-backed vultures were well distributed and in some places abundant in South-east Asia during the first half of the 20th century; now both species are extinct across almost the entire area with relict populations remaining in Myanmar, Southern Laos and Cambodia (Duckworth et al. 2004). Vulture numbers in Cambodia may have temporarily increased during the Khmer Rouge in the 1970's due to the abundance of human and livestock carcases (Tan Setha pers. comm.) A few isolated nests have been found but there are few known breeding colonies. Recent survey work in Cambodia (Tan and Clements pers com) and Myanmar (Htin Hla 2003) indicate that there are remaining populations of white-backed and slender-billed vultures in these countries, but there is little information about total population abundance or locations and sizes of breeding colonies. Remaining birds in South-east Asia appear to have low breeding success (e.g. Timmins & Ou Ratanak 2001). There is insufficient data about breeding success or population structure in South East Asian vulture populations to draw conclusions about their status.

3.2.2 Indian subcontinent

Rapid vulture population declines were first documented in a breeding colony of *Gyps bengalensis* in Keoladeo National Park, eastern Rajasthan, India (Prakash 1999). Numbers of breeding pairs in the Park declined steadily through the late 1990s and by 2000 there were no breeding pairs left (Prakash *et al.* 2003). Data on population changes over a wider area were obtained by repeating a road transect survey of raptor populations carried out across a large area of northern India in 1991 – 1993. Repeat coverage of transects in 2000 indicated that the vulture declines extended across all of northern and central India and occurred for *Gyps indicus* and *G. tenuirostris* combined (these two species had not been distinguished from each other at that time) as well as for *G. bengalensis* (Prakash *et al.* 2003). Soon after the separate identity of *Gyps indicus* and *G. tenuirostris* was recognised (Rasmussen and Parry 2001), surveys repeated in 2002 and 2003 separated counts of these two species. The minimum decline in *Gyps bengalensis* numbers in India during the period 1992-2003 was 99.7% and 97.4% for *Gyps indicus/tenuirostris* (Prakash *et al.* in prep). This corresponds with a minimum estimated rate of decline of 34% per year for *G. bengalensis* and 27% per year for the *G. indicus/tenuirostis* group. In the most recent census, there is evidence that the rate of declines may be increasing with a measured 81% decline between 2002 and 2003 in *G. bengalensis*, a 59% decline in *G. indicus* and an 47% decline for *G. tenuirostris* (Prakash *et al.* in prep.). The road transect surveys only provide evidence about the declines in the three resident *Gyps* species; the evidence available for several other scavenging species is sparse.

Intensive monitoring of *Gyps bengalensis* breeding colonies in Punjab province, Pakistan documented declining numbers of breeding pairs between 2000 and 2003 coupled with high adult mortality rates (Gilbert *et al.* 2002; Virani *et al.* 2002). Numbers of pairs recorded in the province declined by 92% in three years (M. Gilbert unpublished data), which is equivalent to an average rate of decline of 57% per year.

It is possible that population changes measured at individual breeding colonies may only reflect local population trends. Numbers at colonies can fluctuate if birds abandon or move between colonies. Therefore, to determine overall changes in population numbers, it is best to use estimates derived from both small and large scale monitoring. The combination of the colony monitoring and the nationwide surveys provide strong evidence that the declines are rapid and widespread across India and Pakistan.

Surveys of vultures in lowland Nepal indicate considerable population declines, though they may not be as rapid as those in India and Pakistan (Baral 2003). The declines appear to be more pronounced in Eastern Nepal, where numbers are currently low, than Western Nepal.

Very limited information is available about the status and distribution of the least common resident Asian species *Gyps tenuirostris*. Although no true population censuses have been conducted on the slender-billed vultures, total population size has been roughly estimated and may be as low as 150-200 breeding pairs.

From the limited evidence available, populations of *Gyps fulvus* in Central Asia do not appear to be declining rapidly. Numbers of *G. fulvus* have been slowly declining across Central Asia, probably as a result of changing farming practices reducing the availability of livestock carcasses (Katzner *et al.* 2004). There is very limited monitoring of *G. fulvus* numbers within the Indian subcontinent. Population trends for *Gyps himalayensis* are not known.

All three vulture species were continuing to decline at the time of the most recent surveys in India, Pakistan and Nepal (2003). Populations are now declining by more than 50% per year for some species and locations and the rate of decline has increased in recent years.

4 Role of vultures in ecosystems and the provision of ecosystem services

Vultures play a key ecological role in the Indian subcontinent. In many areas, religious and cultural beliefs forbid the consumption of meat, but because milk is a dietary staple, there are a large number of livestock carcasses available to scavengers. With the decline in numbers of resident vulture species, there is now a superabundance of food (Prakash *et al.* 2003). Concurrently, and probably in response to the increased food availability, there appears to be an increase in resident feral dog populations and in migratory scavenging birds such as steppe eagles *(Aquila nipalensis)* and Eurasian griffon vultures over-wintering in India. The increase in feral dog populations could have serious consequences for human and wildlife health, as dogs are carriers of several diseases that affect human beings, wildlife and livestock, including rabies, distemper, and canine parvovirus (Pain *et al.* 2003). India has the highest incidence of human rabies in the world, with the majority of these stemming from dog bites (Singh *et al.* 2001; Dutta 1999). The accumulation of dead livestock carcasses may have implications for groundwater safety and for livestock borne disease such as tuberculosis and anthrax (Prakash *et al*. 2004). Vultures also play a key role in Parsi beliefs, as their dead are not buried, but are left to be eaten by birds in sky burials. The most famous site is the Towers of Silence in Mumbai where thousands of vultures used to congregate around the towers. Now they are only attended by smaller and less effective avian scavengers (Parry-Jones 2001).

5 Potential causes of rapid population declines

In diagnosing the causes of animal population declines it is important to devise a list of possible candidate causes based upon expert knowledge of the ecology of the species and the environment in which it lives (Caughley 1994). Workshop participants gave careful consideration to a wide range of environmental changes that could act as external causes of vulture population declines. It was recognised that such changes must have their effect via demographic mechanisms, that is changes in demographic rates, such as survival, immigration/ emigration and breeding success. It was concluded that large-scale net emigration of vultures could not be the demographic mechanism of the observed declines

because they had been observed over a large proportion of the species' geographical ranges and there was no evidence of a compensating increase in numbers elsewhere. Hence, the external causes of the population declines must have reduced adult survival, immature survival, the proportion of birds of breeding age that attempt to breed, the success of breeding attempts at the egg stage, the success of breeding attempts at the nestling stage or some combination of these. Eight effect pathways were constructed by which environmental changes could cause changes in these demographic rates as follows;

1 Loss of nesting habitat

2 Infectious diseases

3 Use of veterinary drugs

4 General environmental contamination

5 Deliberate poisoning of carnivores leading to secondary poisoning of vultures.

6 Low food availability

7 Exploitation and persecution

8 Effects of transportation, infrastructure, and recreation

These pathways are set out in Figures 5.1 – 5.8. The figures are flow charts with demographic mechanisms of population change shown at the top of the chart and proximate environmental changes that cause changes in demographic rates shown below them and linked to them by lines indicating causation. These environmental changes themselves have other causes shown below the proximate causes. Thus the charts show putative chains or networks of causation progressing from ultimate external causes to the bottom, through more and more proximate external causes further up, and finally to demographic mechanisms of population change at the top. It should be noted that workshop delegates attempted to cover the range of potential causes of declines as comprehensively as possible, though they excluded effects that seemed extremely implausible. Hence, these tables show *candidate* effect pathways, *not* established causes of population declines. An evaluation of the evidence for different effect pathways is presented in section 6.

Figure 5.1 Potential causes of rapid population declines: loss of nesting habitat

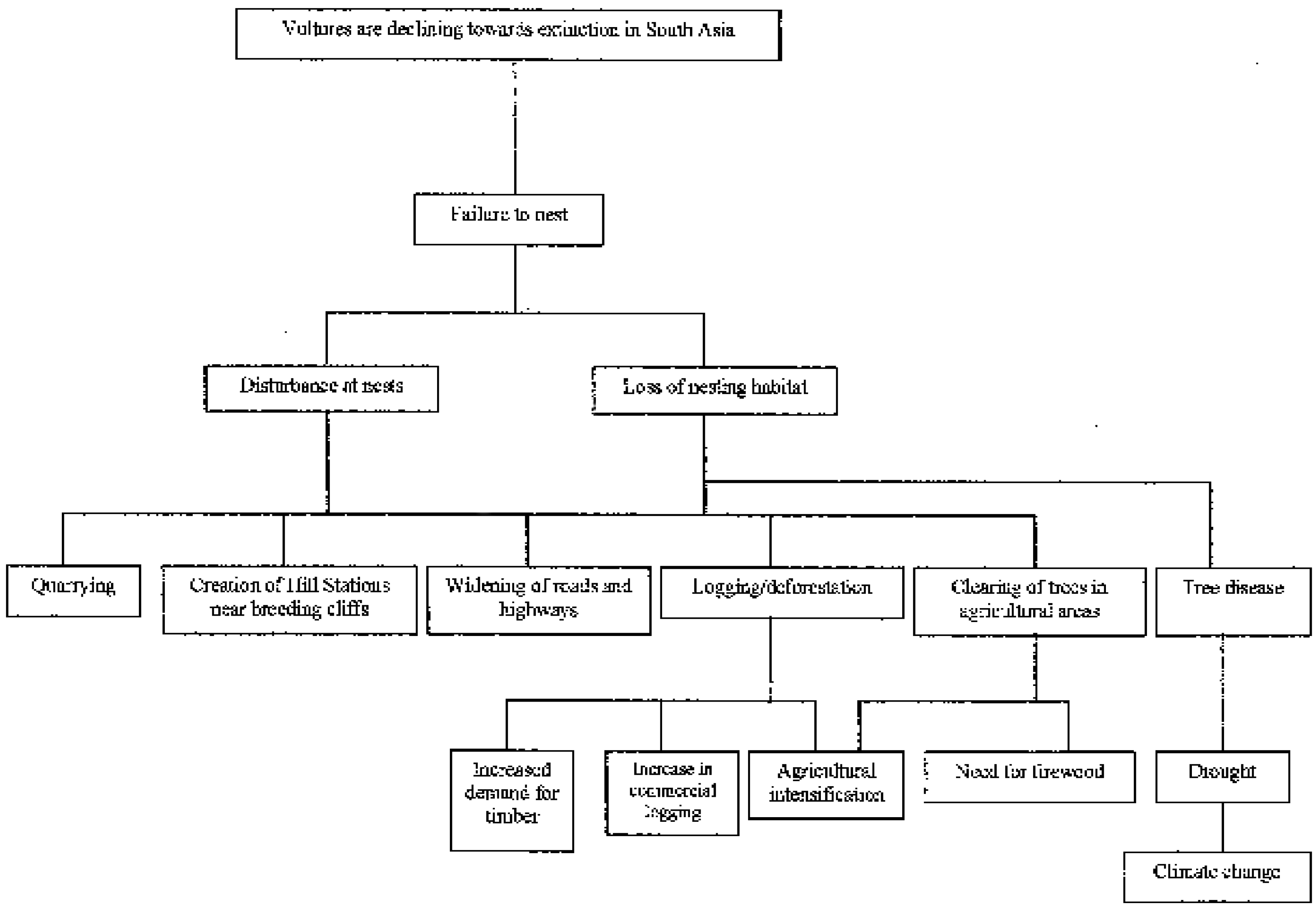


Figure 5.2 Potential causes of rapid population declines: infectious diseases

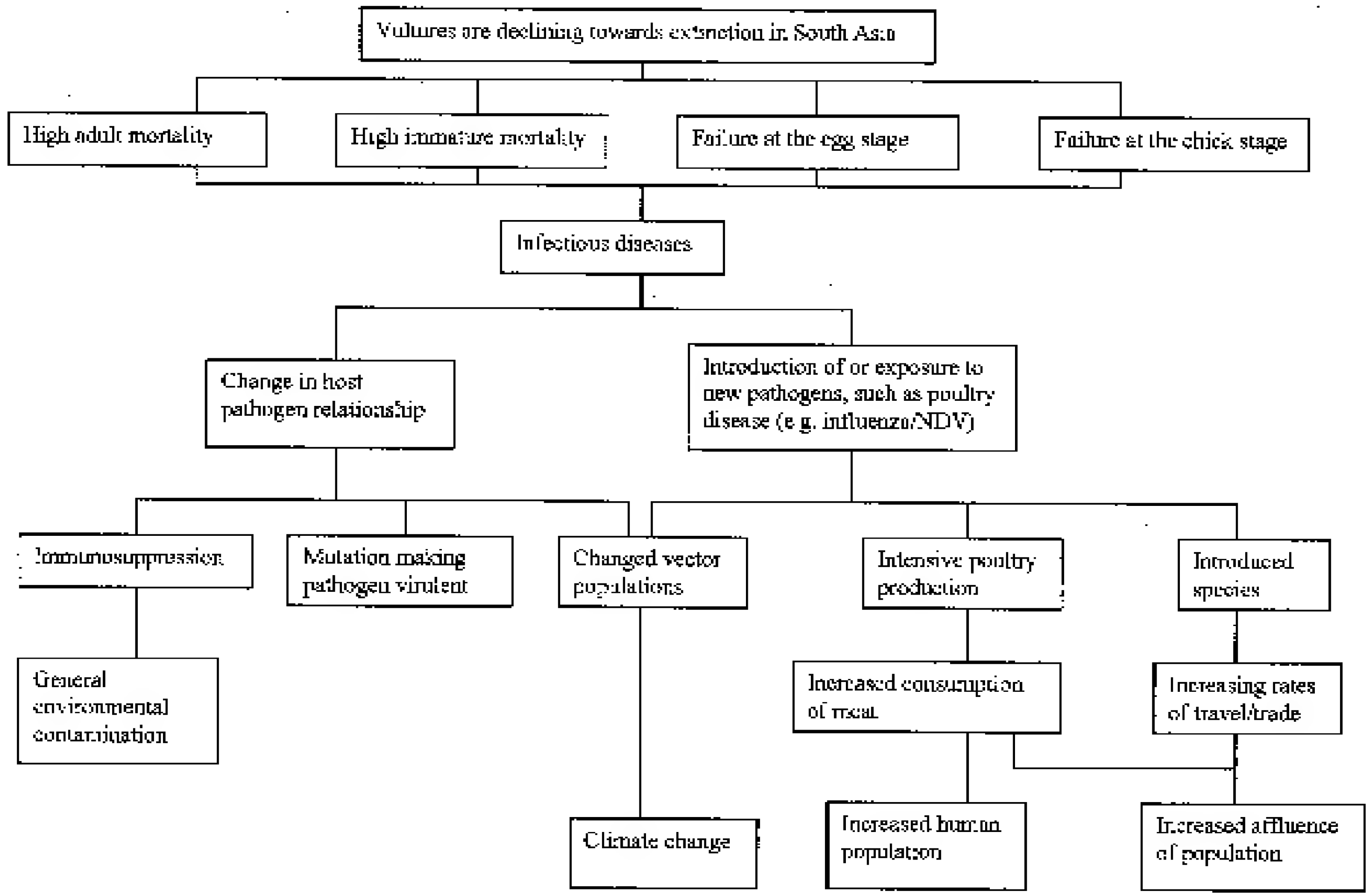
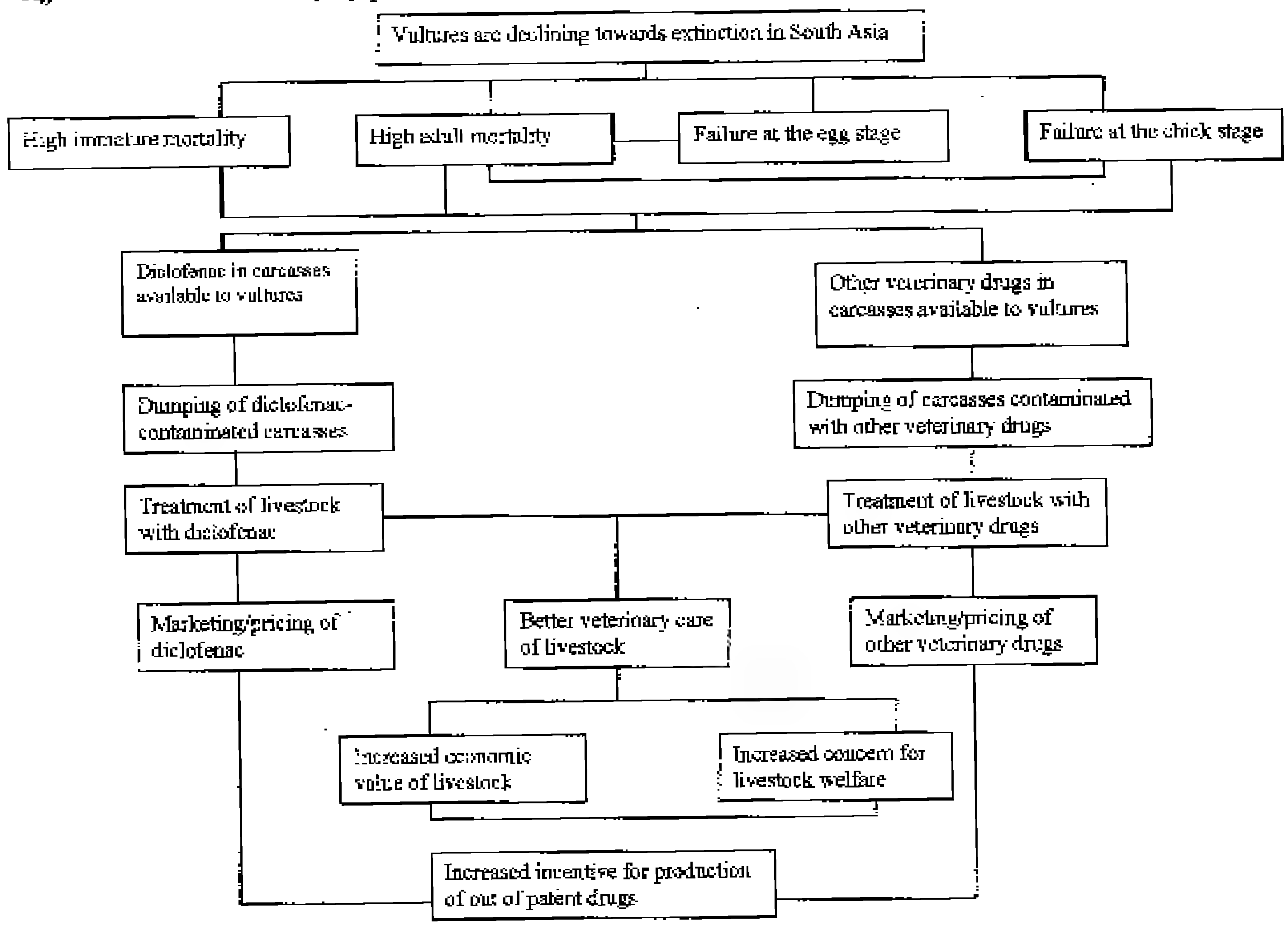


Figure 5.3 Potential causes of rapid population declines: use of veterinary drugs



South Asian vulture recovery plan

Figure 5.4 Potential causes of rapid population declines: general environmental contamination

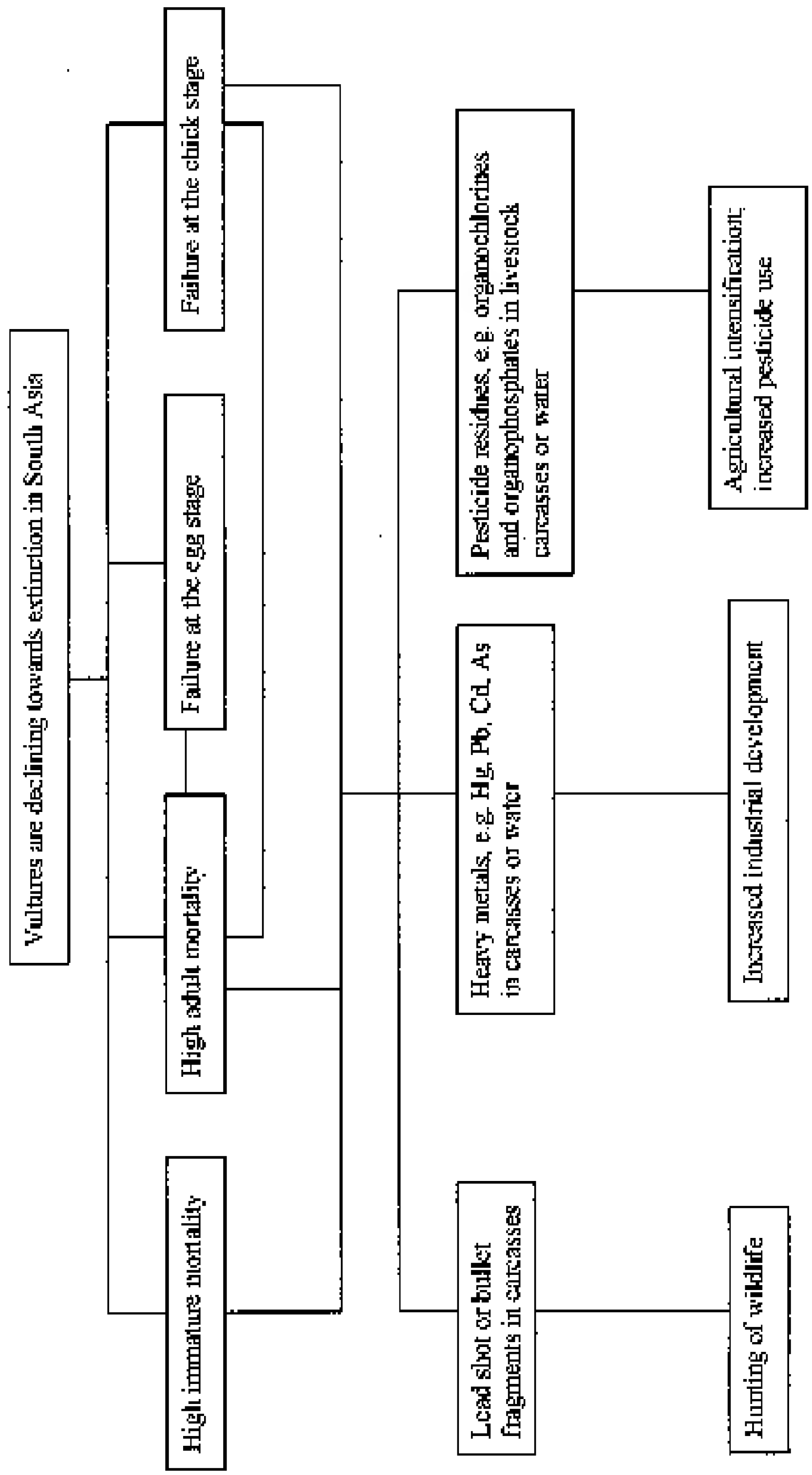


Figure 5.5 Potential causes of rapid population declines: deliberate poisoning of carnivores leading to secondary poisoning of vultures.

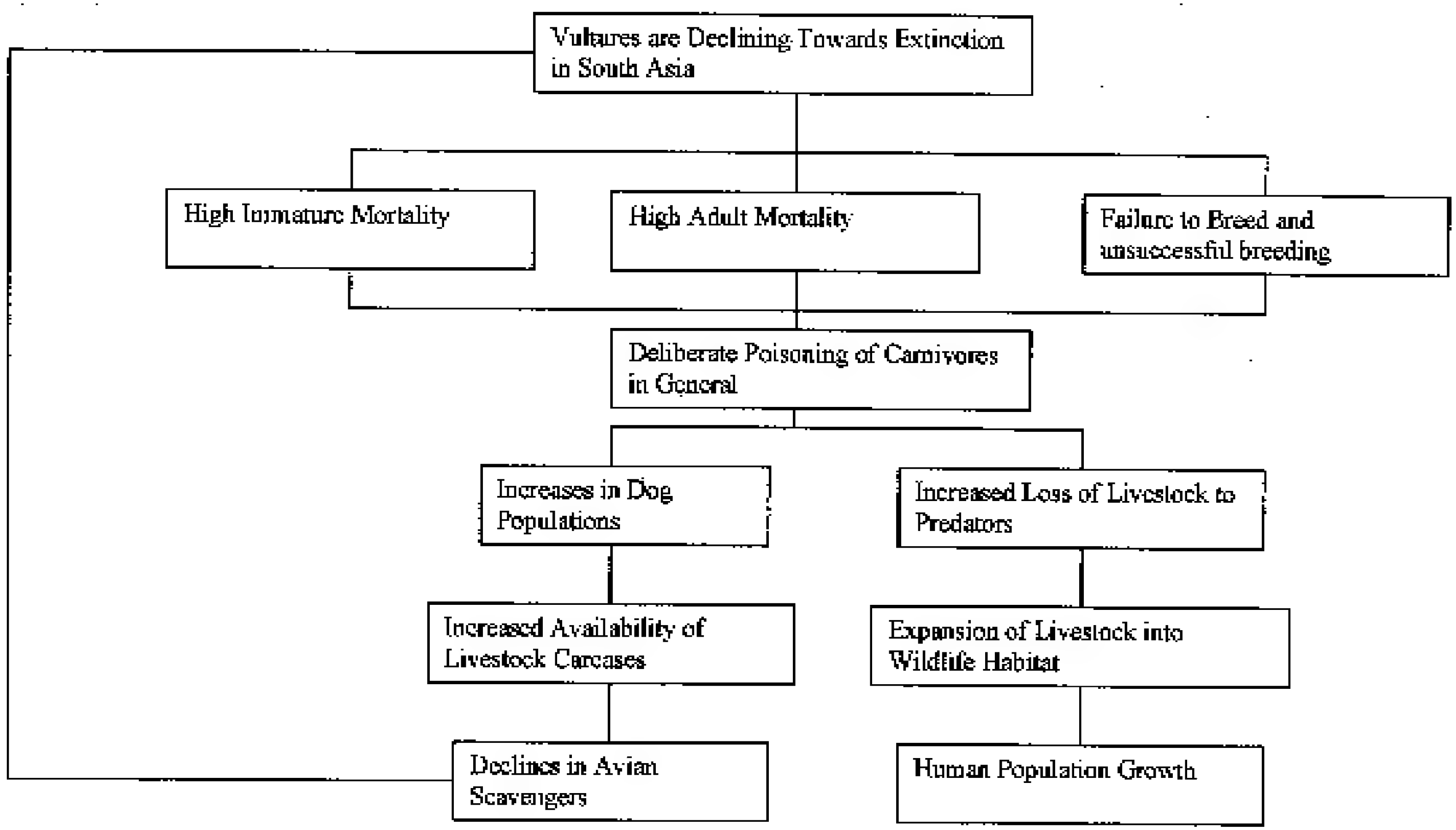


Figure 5.6 Potential causes of rapid population declines: low food availability

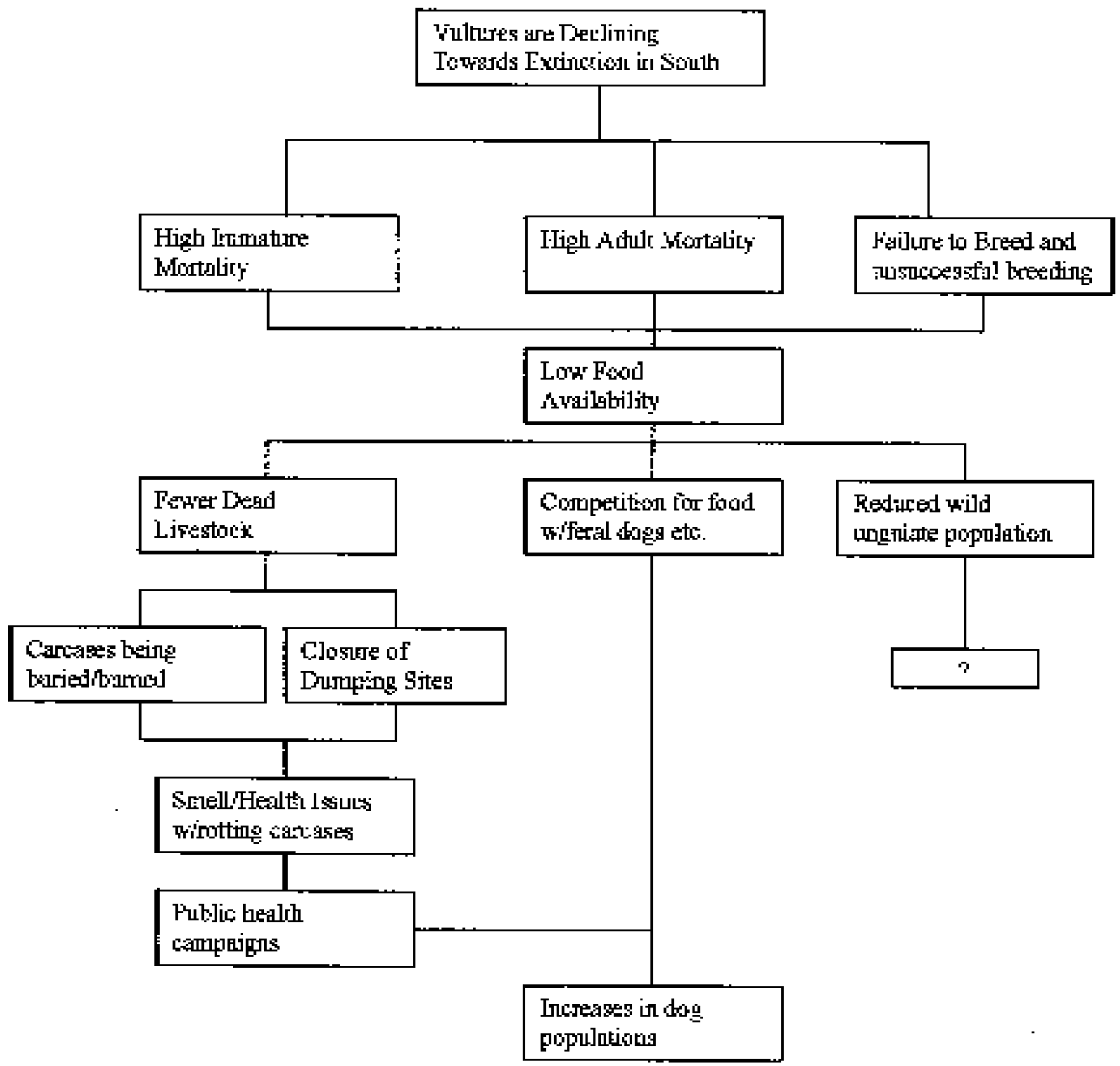


Figure 5.7 Potential causes of rapid population declines. exploitation and persecution

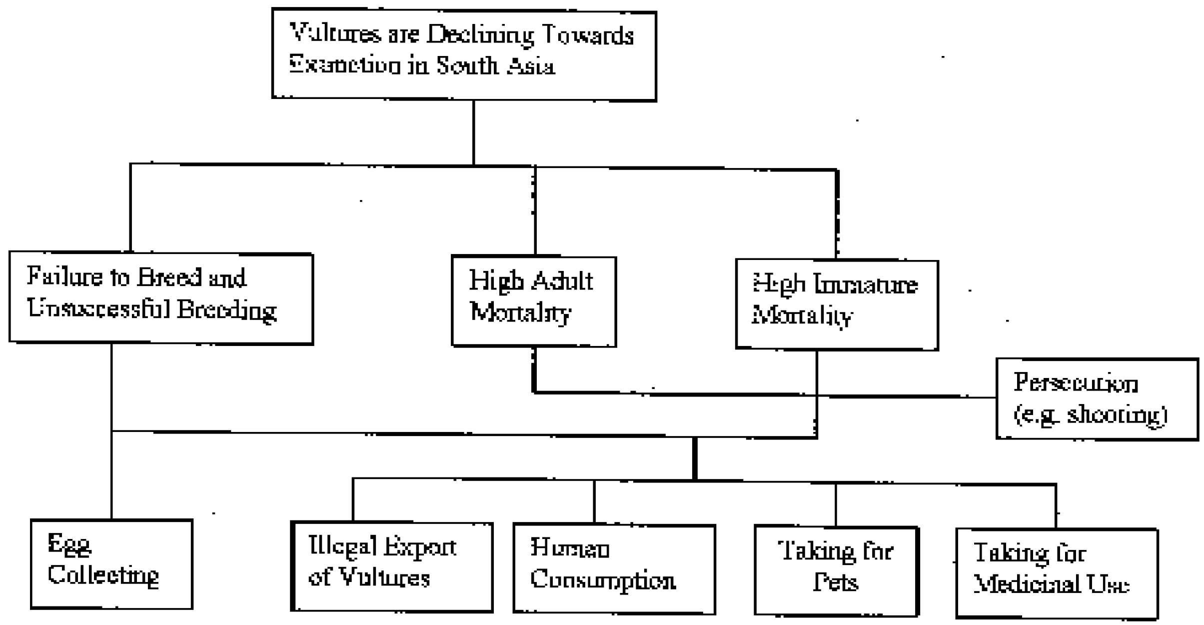
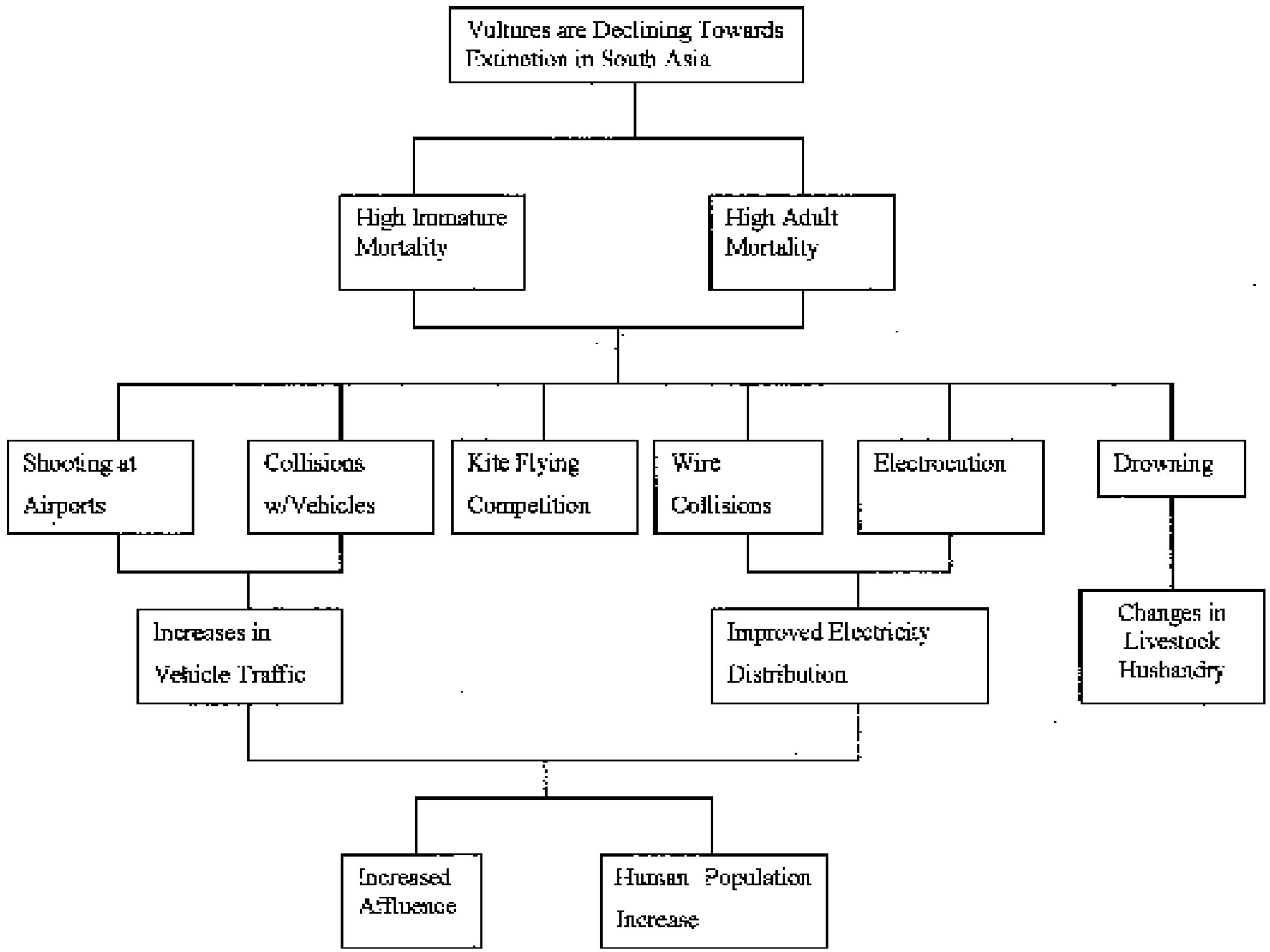


Figure 5.8 Potential causes of rapid population declines: transportation, infrastructure, and recreation



6 Evidence for the importance of potential causes of rapid vulture population declines

6.1 Loss of nesting habitat

6.1.1 Indian subcontinent

There is some anecdotal evidence of disturbance at cliff nesting sites of long-billed vultures due to quarrying activities. Nesting sites of white-backed vultures are threatened by logging activities and concessions at some sites in Nepal (Baral 2003). However, in India, most of the nesting habitat, both within and outside of protected areas is not currently threatened or affected by disturbance.

6.1.2 South-East Asia

In South-East Asia, there is too little information available about nesting sites for the Gyps species to infer whether they are under threat. However, assuming that the nesting requirements of white-backed and slender-billed vultures are the same in South East Asia as in the Indian subcontinent there should be no shortage of nesting habitat (T. Clements pers. comm.)

6.2 Infectious diseases

6.2.1 Indian subcontinent

The most consistent post mortem finding in examined vulture carcasses is visceral gout, an accumulation of uric acid within tissues and on the surfaces of internal organs. Visceral gout is caused by renal failure, which is known to occur as a result of metabolic, infectious or toxic disease (Crespo and Shivaprasad 2003). Visceral gout has been observed in approximately 85% of dead adult and sub-adult birds collected in Pakistan (Oaks *et al.* 2004). In India, previous reports of lesions in vultures include both vultures captured prior to death and carcases collected in the field. Of the small sample of carcases collected in India, 75% of adult and sub-adult wild birds found dead had visceral gout (Cunningham *et al.* 2003).

Other *post mortem* findings in examined birds both with and without visceral gout include enteritis (inflammation of the intestinal tract), vasculitis, ganglioneuritis and gliosis, i.e. inflammatory responses around vascular tissue, peripheral nervous and central nervous tissue respectively (Cunningham *et al*. 2003, unpubl. data). However, whilst the incidence of these lesions appeared to be high, the lesions themselves were generally subtle. Both the disruption of tissues by uric acid crystals and the presence of post mortem autolytic changes in birds found dead with gout would be expected to mask signs of any other lesions that may be present. It is not possible, therefore, to know the true incidence of lesions such as vasculitis, gliosis, etc., in the birds found dead with gout. Sick vultures in India become increasingly weak over days or weeks before death and are seen to 'head droop' with increasing frequency as they become further incapacitated (Prakash 1999). Birds exhibiting neck drooping behaviour that have been brought into captivity have elevated white blood cell counts, especially of monocytes (Cunningham unpubl. data). However, nearly all birds brought into captivity and given intensive fluid therapy have apparently 'recovered' and are still being held at the vulture care centre in Pinjore.

Oaks *et al.* (2004) failed to find evidence of avian influenza and West Nile virus, infectious diseases associated with renal failure, in *Gyps bengalensis* found dead in Pakistan. Attempts to isolate viruses from the kidney, spleen, lung and intestine of these birds were unsuccessful. Oaks *et al.* (2004) identified a novel mycoplasma by PCR in *Gyps bengalensis* found dead in Pakistan. The prevalence of this mycoplasma was similar in birds with and without visceral gout. Captive *Gyps bengalensis* given a preparation made from tissues of vulture carcasses, including individuals with and without gout, to test for transmission of the mycoplasma or other infectious agent. No signs of disease occurred in the inoculated birds within 6 weeks of treatment.

The results of some of the pathological studies on vultures from India suggest the presence of an infectious, probably viral, aetiology (Cunningham *et al.* 2003). A herpes virus has been isolated and sequenced from affected vultures by the PDRC and the Australian Animal Health Laboratory. This virus has been shown to be present in tissues from vulture carcasses collected across India and is found at the highest concentrations in and around lesions in the central nervous system (Cunningham *et al*., unpubl. data). However, it is not yet clear whether the lesions are sufficient to cause morbidity or death or whether the presence of this virus is associated with any of the pathological signs observed in birds found dead during the rapid population decline, especially visceral gout. Many types of herpes virus are

endemic to their hosts and are found in a high percentage of the population but are not necessarily associated with serious pathology (L. Oaks pers. comm.).

6.2.2 South-East Asia

There has been an unverified report of a vulture fatality in a Cambodian zoo caused by the avian influenza virus 'H5N1', but there is no evidence that the virus has spread into the wild vulture population (T. Clements pers. comm.). Blood samples have been taken from captured Gyps vultures in Cambodia, which can be used to provide evidence for the presence of pathogens in the wild populations.

6.3 Use of veterinary drugs

6.3.1 Indian Subcontinent

Recently Oaks *et al.* (2004) reported 219 of 259 adult and sub adult Gyps bengalensis found dead in Pakistan had visceral gout. In Pakistan, twenty-five *Gyps bengalensis* that were found dead with evidence of gout had detectable levels of the veterinary drug diclofenac in their kidneys, whereas diclofenac was not detectable (detection limit 0.005-0.01 mg kg^{-1}) in any of 13 birds that did not have gout. Based on this perfect correlation between the incidence of gout and the presence of diclofenac and the high incidence of visceral gout in adult and subadult *Gyps bengalensis* found dead in Pakistan, it can be estimated that 85% of dead vultures of these age classes contained residues of diclofenac. Evidence suggests that the situation is broadly similar in India (Shultz *et al.* 2004).

Experimental treatment of captive *Gyps bengalensis* with diclofenac and tissues from livestock that had been treated with diclofenac showed that the birds were killed by consuming tissues of animals treated with the normal veterinary dose of diclofenac a few hours before slaughter (Oaks *et al.* 2004). The mortality rate of treated vultures was dose-dependent and indicated a median lethal dose of about 0.1 mg kg^{-1} (dose per unit vulture body weight). The experiment with captive birds also indicates that virtually all *Gyps bengalensis* consuming 0.8 mg kg^{-1} would be killed. Assuming that mortality rates of wild *Gyps bengalensis* are similar to those of captive birds and that a vulture's average meal size is sufficient to supply 3 days' free-living energy requirements, it would be expected that an average concentration of 0.5 mg kg^{-1} in ungulate tissue consumed by *Gyps bengalensis* would be sufficient to deliver the median lethal dose and that 3.7 mg kg^{-1} would be sufficient to kill virtually all birds. These calculations assume that the food requirement of free-living vultures can be calculated using the method of Mundy et al. (1992) and that the mean weight of *Gyps bengalensis* is 4.67 kg (M. Gilbert, unpublished data).

Diclofenac is a member of the non-steroidal anti-inflammatory drug (NSAID) group that includes aspirin and ibuprofen and it has been widely and safely used in humans to treat pain, fever and inflammation since its introduction on the market in the 1970's. It is not approved for veterinary use in North America or Europe but has recently been marketed in the Indian subcontinent to treat livestock. It is by far the most commonly available veterinary painkiller in India and has been in use for at least a decade. It has been suggested that diclofenac was introduced into veterinary use sometime between 1988 and 1994. Several Indian drug manufacturers export veterinary products containing diclofenac to neighbouring countries where is it believed their use is spreading. Diclofenac is manufactured and marketed in Pakistan where it has been in use since about 1998. Reports suggest that veterinary diclofenac is produced, used in, and exported from China. Diclofenac is also in veterinary use in Nepal and Bangladesh (Risebrough in press; 2004).

Exposure of vultures to diclofenac is presumed to occur through the consumption of carcasses of livestock that have been treated with diclofenac shortly before death. Along with other NSAIDs, high doses of diclofenac can cause kidney failure in birds, which could explain the severe visceral gout observed in many of the vulture carcases collected in India and Pakistan. NSAIDs suppress inflammation and pain by inhibiting the production of the cyclo-oxygenase (COX) enzymes, which are necessary in the formation of prostaglandins. However, COX enzymes also act to protect stomach and intestine lining and help maintain normal kidney function. Through inhibiting the production of COX enzymes, NSAIDs can cause impaired renal function and gastro-intestinal inflammation (Murray and Brater 1993).

Experimental evidence suggests that diclofenac is quickly metabolised in mammals, with a half-life in human plasma estimated to be around 3.5-4 hours (Todd and Sorkin 1988). Although there is little documentation, residence times in tissue is expected to also be short, as diclofenac is not

believed to bio-accumulate. Known side effects of diclofenac in humans include abdominal pain or cramps, constipation, diarrhoea, headache, indigestion, nausea, peptic ulcers. More rarely diclofenac can cause kidney failure and liver disease.

An obvious question arises as to whether it is plausible for diclofenac to be common enough in the environment to cause the observed widespread declines. In order to address this question, Green et al. (2004) present a simulation model to predict the necessary prevalence of diclofenac in livestock carcasses to produce the observed declines. A very low prevalence of carcasses with lethal levels is sufficient to result in the observed rates of decline (less than 1 in 250). Additionally, the proportion of adult and subadult birds found dead or dying which have visceral gout is consistent in both Pakistan and India with expectations from the model if diclofenac was the sole cause of the declines in both countries. This assumes that visceral gout is a reliable indicator of death from diclofenac poisoning. This assumption is strongly supported by results from Pakistan showing a perfect correlation in dead wild vultures between presence of diclofenac and visceral gout. Unpublished observations from India also support this assumption (Shultz *et al.* 2004).

6.3.2 South-East Asia

Diclofenac is available for human use in South-East Asia. There are two anecdotal cases of human preparations being sold for veterinary use (T. Clements pers comm.). A survey of five range provinces in Cambodia indicates that diclofenac is not available for veterinary use.

6.4 General environmental contamination

6.4.1 Indian subcontinent

Post-mortems were carried out on 42 white-backed vultures from Pakistan, collected between 2000 and 2002 (33 adult and 9 juvenile birds). Of these, 28 birds had visceral gout, 14 did not. These birds were screened for a wide range of contaminants detailed in the following list (number of birds tested in brackets): cadmium (39), mercury (37), arsenic, copper, iron, manganese, molybdenum, zinc (all 39), carbamate and organophosphate pesticides (34), organochlorine pesticides and polychlorinated biphenyls (13). Most tests were either negative or found at below toxic concentrations. There was one case of lead toxicity in a non-gout case and one case of probable organophosphate poisoning. No deficiencies of essential elements were apparent (Oaks *et al.*, 2004). Limited tissue analyses of Indian vultures were conducted and similarly found no toxic levels of a small range of pesticides tested (Prakash *et al.*, unpublished data). Environmental contaminants have been known to cause heavy mortality in other vulture and raptor populations and can be very difficult to identify and detect by routine monitoring. The monitoring conducted so far has been of a limited nature and there is a need to collect more information on the threats posed by environmental contaminants.

6.4.2 South-East Asia

There are no reported cases of vulture mortality due to environmental contaminants. There is widespread use of poisons used in water sources, which is a potential source of contamination.

6.5 Deliberate poisoning of carnivores leading to secondary poisoning of vultures

6.5.1 Indian subcontinent

Deliberate or accidental poisoning can have a significant impact on raptor populations, especially on communal feeders such as vultures. Poisoning campaigns eliminated scavenging birds and large eagles from the huge stock farming area of Namibia in the 1980s. However, in the neighbouring National Parks of Kalahari Gemsbok and Etosha these same species remained abundant (Mundy *et al.* 1992). Whilst a significant threat in Africa, direct persecution is unlikely to have played a large part in the vulture declines across the Indian sub-continent. Vultures are generally valued within Indian society for their role in environmental health. They also have an important cultural and religious significance. The Parsi religion depends upon vultures to remove their dead, and the vulture king, Jatayu, is an important figure in Hindu religion. Targeted poisoning of carnivores almost certainly occurs, but because it is illegal, and is carried out in a clandestine manner, it is very difficult to assess the extent or importance of this threat. Additionally, it is believed that livestock poisoning to obtain hides is a fairly common phenomenon and may result in vultures being exposed to contaminated carcasses. However, as with diclofenac poisoning, only a small number of contaminated carcasses could have serious population

consequences for vultures. There continues to be a need to assess the scale and importance of poisoning in causing vulture mortality.

6.5.2 South-East Asia

In South-East Asia, there is little evidence for or against the role of poisoning in the historical vulture declines (Pain *et al.* 2003).

6.6 Low food availability

6.6.1 Indian subcontinent

Across the Indian sub-continent, there is considerable evidence that food availability for vultures has remained high. During nationwide vulture surveys in India in 2000, Prakash et al. (2003) recorded numbers of livestock carcasses seen and any scavengers present. Only 12 (<5%) of 262 carcasses seen had attendant vultures; most were attended by crows *Corvus* spp. and feral dogs. Counts of *Gyps* vultures at three carcass dumps that remained active between 1990 and 2000 showed 87-100% declines in the numbers of visiting vultures. In 1999, of 1,920 completed questionnaire returns, c.80% of respondents indicated that dumping of carcasses in the open remained the predominant form of disposal in their region (Prakash *et al.* 2003). Whilst carcasses remained common and available to vultures, there was some indication that carcasses were less abundant than 10 years ago (76% of respondents reported carcasses as fairly or very common in 1990; 63% in 2000). Although few data exist, there is some evidence that the red-headed vulture underwent a significant (p=0.03) but less severe (48%) population decline between 1991-93 and 2000 (Prakash *et al.* 2003). This is further supported by a reanalysis of these data including the results for 2003 (Prakash *et al.* in prep). It is conceivable that, in the absence of the mortality factor that has caused the *Gyps* population crash, numbers of avian scavengers could be declining slowly in India due to a gradual reduction in available food. However, although monitoring data are scarce, populations of other scavenging birds show no obvious signs of decline, and some scavengers, such as feral dogs, are reported to be increasing across India (Cunningham et al. 2001). Finally, there has been no evidence of starvation being a contributing factor to the death of vultures necropsied from across India and Pakistan (Gilbert *et al.* 2002; Prakash *et al.* 2003). Consequently, food shortage is an unlikely explanation for the recent vulture population crash across the Indian sub-continent.

6.6.2 South-East Asia

Pain *et al.* (2003) state that food shortage in the latter part of the 20th century may have played a major part in vulture declines in South-East Asia. Wild ungulate populations crashed in the region from uncontrolled hunting (e.g. Srikosamatara & Suteethorn 1995; Duckworth et al. 1999; Hilton-Taylor 2000) and there has been a massive reduction in the number of free ranging livestock (e.g. Cambodian Wetland Team 2001), and consequently in carrion available for vultures. Meat is commonly removed from carcasses for consumption, resulting in a further limitation of food available for the vultures (Clements *et al.* 2004). Food supplies may be reliable enough to allow regular breeding only in localised areas.

6.7 Exploitation and persecution

6.7.1 Indian subcontinent

The use of vultures in traditional medicine is localised and not intense enough to be responsible for the observed nationwide declines.

6.7.2 South-East Asia

Anecdotal evidence suggested that wild vultures are sometimes caught and held as pets. Vulture parts are also used in traditional medicine, so there is some level of persecution to supply the medicinal trade, but its extent is unknown. There is some anecdotal evidence that the traditional medicine trade has increased through the 1990s.

6.8. Transport, infrastructure and recreation

6.8.1 Indian subcontinent

Before vulture numbers were significantly reduced, vulture collisions with aircraft were a serious concern. The number of fatalities caused by these crashes is unlikely to have had a measurable effect on vulture numbers, but the scale of shooting and poisoning to reduce vulture numbers near airfields is completely unknown and could potentially have been a contributory factor in their declines. There are infrequent records in India of incidental vulture mortality due vulture collisions with automobiles, trains, power lines, and kite strings. During the past two years, five white-back vulture deaths have been reported during the kite flying festival in Ahmedabad, Gujarat.

6.8.2 South-East Asia

Due to the lack of power lines and road infrastructure in Cambodia and Myanmar, there is probably little threat to vultures from these sources.

6.9 The capacity of changes in particular demographic rates as mechanisms underlying rapid declines of vulture populations

The workshop considered the sensitivity of the rate of vulture population change to changes in demographic rates (prevalence of breeding, breeding success, pre-reproductive survival of full-grown birds, adult survival). It was noted that population studies of vultures and other large raptors have found them to be long-lived once they reach adulthood. Annual adult survival rates are often in the range 90-97%, typically about 95%. With 95% adult survival even complete cessation of breeding, complete breeding failure or 100% pre-reproductive mortality could only produce adult population declines at a maximum rate of 5% per year. The observed vulture declines have occurred at rates of 20% to 50% per year. Hence, the important factors causing the declines must have substantially reduced the annual survival rate of adult vultures. This effectively excludes loss of nesting habitat and any other factor that mainly changes breeding output as an important cause of the rapid declines.

6.10 Conclusions about the importance of and strength of evidence for causes of rapid population declines

Based on discussion of the evidence presented in the sections above, the workshop assessed the importance of each potential cause in each range state and evaluated the strength of the scientific evidence for the assessment. The results are shown in Table 6.1. It should be stressed that each assessment was made by a poll of the whole group and all participants, regardless of individual expertise, received the same weight. However, it was clear that that delegates had weighed the evidence presented carefully and that the views of specialists, when well supported by reasoning or evidence, did have a strong influence. Examination of Table 6.1 shows that the use of veterinary drugs was rated as of particular importance in the core range states and the supporting evidence was generally rated as strong. The potential cause of rapid declines rated next most important was infectious disease, but there was considerable variation in the assessments made for different range states. For Pakistan, the assessment was that infectious disease was of little importance and that the evidence for that view was strong. However, the importance of infectious disease was rated as moderate for India, though the level of supporting evidence for this was rated as quite low. There was general acceptance by those who believe that infectious disease may have played a role in the rapid population declines that the supporting evidence is inconclusive at present. Other potential causes of rapid declines were generally rated as unlikely to be of much importance.

The workshop recognised that some factors that might not have caused the observed recent declines might act in the next ten years to prevent or slow recovery, even if the main causes of the decline were eliminated. An assessment of all the potential causes of declines as factors with potential to hinder recovery is given in Table 6.2.

Threats	India	Pakistan	Nepal	Myanmar	Bangladesh	Cambodia	Bhutan	Others
Loss of Habitat	★ ◇ ◇ ◇ ◇ -	★ ◇ ◇ ◇ -	★ ◇ ◇ ◇ -	?	?	?	X	✔
Infection Diseases	★★★ ◇ ◇ +	★ ◇ ◇ ◇ ◇ -	★★ ◇ ◇ +	?	✔	?	✔	✔
Use of veterinary Drugs (Diclofenac)	★★★★ ◇ ◇ ◇ +	★★★★ ◇ ◇ ◇ ◇ +	★★★★ ◇ ◇ +	X	✔	X	✔	✔
General Environmental contamination	★ ◇ ◇ -	★ ◇ ◇ ◇ -	★ ◇ -	✔	✔	✔	✔	✔
Deliberate poisoning of carnivores	★ ◇ ◇ -	★ ◇ ◇ -	★ ◇ ◇ -	?	?	?	?	?
Low Food availability	X	X	★ ◇ ◇ -	✔	?	✔	?	✔
Exploitation and persecution of vultures	X	★ ◇ ◇ ◇ -	X	?	?	✔	X	?
Transportation, Infrastructure and Recreation	X	★ ◇ ◇ ◇ -	X	X	?	X	X	?

Table 6.1 **Assessment of the importance and strength of available evidence on effect pathways as causes of recent rapid population declines**

★ Importance, ✔ Worthy of consideration, but little or no evidence; ◆ Strength of evidence, +/- For or Against X Unlikely to be important

Table 6.2 Assessment of the possible importance of effect pathways in causing further declines or impeding recovery in the next 10 years.
✔ Worthy of consideration X Unlikely to be important

Threats	India	Pakistan	Nepal	Myanmar	Bangladesh	Cambodia	Bhutan	Others
Loss of Habitat	X	✔	✔			?		
Infection Diseases	✔	✔	✔			?		
Use of veterinary Drugs (Diclofenac)	✔	✔	✔			✔		
General Environmental contamination	✔	✔	✔			✔		
Deliberate poisoning of carnivores	✔	✔	X			✔		
Low Food availability	✔	✔	✔			✔		
Exploitation and persecution of vultures	✔	X	X			X		
Transportation, Infrastructure and Recreation	X	X	X			✔		

7 ACTION PROGRAMME

7.1 Vision

This is the anticipated long-term outcome of the plan. The vision of the Species action plan is to prevent the extinction of the three Asian *Gyps* vulture species and to restore populations of all of them in the wild as widespread species within their historical range.

7.2 Aims

The aims outline what outcomes the plan is designed to achieve during its lifetime. The two aims of the plan are to: 1) remove the causes of vulture declines by 2010, and 2) to establish six self-sustaining populations of vultures in the wild by 2030.

7.3 Objectives of recovery actions for vultures in the wild

The objectives for the recovery of Asian *Gyps* vulture populations in the wild are based on four topic groups as identified by workshop participants from the list of possible factors presented in section 5. These groups are considered the most important areas where current and future conservation activities on wild and restored populations should be focused. The establishment and management of captive populations are considered in section 8. These topic groups are: use of veterinary drugs, infectious disease, population monitoring needs, and future constraints on vulture population recovery. Within each group, a number of recommended activities have been identified as listed in Table 7.1.

7.4 Establishment of Vulture Task Force

In order to verify that objectives are being accomplished and necessary action undertaken, the creation of a vulture task force has been proposed. This will serve as an institutional framework for updating and implementing the Recovery Plan. The task force will be composed of three sub-groups, 1) captive breeding and release (see technical advisory committee below), 2) research and monitoring, and 3) awareness raising, advocacy and education. These sub-groups will monitor progress in each of the areas and update the recovery plan as needed.

Project Table

Topic Group	Project Type	Code	Action	Countries	Overall Priority	Cost	Time Scale	Agencies Responsible/Stakeholders	Indicators
Veterinary Drug Use	Policy and Legislation	1.1a	Ban diclofenac	India	★★★★	Unknown	Immediate Start 1-5 years	Government-Ministry of Environments and Forests, Ministry of Health, State Governments Wildlife Institute of India, Indian Veterinary Research Institute, National Board for Wildlife, Centrally Empowered Committee NGO's- BNHS Wildlife Trust Institute; WWF-India; IUCN-India; RSPB, and international NGO's	Removal of Diclofenac from Veterinary Market
				Pakistan	★★★★		Immediate Start 1-5 years	Government- Ministry of Environment, Ministry of Health, University of Vet and Animal Sciences, Lahore; NGO's- Ornithological Society of Pakistan, WWF-Pakistan, IUCN-Pakistan	Removal of Diclofenac from Veterinary Market
				Nepal	★★★★		Immediate Start 1-3 years	Government- Ministry of Forests and Soil Conservation, Ministry of Health, NGO's- Bird Conservation Nepal, King Mahendra Trust for Nature Conservation, WWF-Nepal, IUCN-Nepal	Removal of Diclofenac from Veterinary Market
		1.1b	Prevent introduction of diclofenac as veterinary drug	Cambodia, Myanmar, Laos, Bhutan	★★★★	Unknown	Immediate-ongoing	? Governmental and non-governmental organisations	Diclofenac remaining out of the veterinary marketplace
	Species and Habitats	1.2a	Identify areas with little or no diclofenac use	India, Pakistan, Nepal	★★★	0	Immediate- <1 year	NGO's- BCN, OSP, BNHS, RSPB TPF, WWF, BirdLife International, WCS	Specific locations identified with little or no use of diclofenac across range states

Monitoring and Research	1.3a	Monitor use and introduction of NSAID veterinary drugs	All Gyps Range Countries	★★★★	◇◇	Immediate - ongoing	**International Governmental Organisations** - IUCN, FAO, CBD, WHO, USFWS, UN Agencies **International NGO's** – RSPB WWF, BirdLife International, WCS, The Peregrine Fund	Database indicating temporal/spatial changes in diclofenac availability and use
	1.3b	Research on alternatives to diclofenac	(South Africa)	★★★★	◇◇-◇◇◇	Immediate <2 years	Governmental- ?, (Indian Veterinary Research Institute); NGO's- RSPB, VSG, OSP, BNHS, NBPT	Identification of safe, effective, and inexpensive alternative NSAIDs
	1.3c	Identify mechanisms of vulture exposure to diclofenac	India, Pakistan Nepal	★★★★	◇	Immediate- <1 year	BNHS, RSPB	Main pathways of diclofenac exposure identified- potential key husbandry groups highlighted
	1.3d	Market research on diclofenac use	All Affected States	★★★	◇	Immediate- <1 year	**NGO's**- BCN, OSP, BNHS, WTI, RSPB, TPF, WWF, BirdLife International, WCS	Available figures on amount of diclofenac distributed to veterinary market in range states, information on principle user groups
	1.3e	Research on impacts of diclofenac on other scavenging species	All Affected States	★★★★	◇-◇◇◇	Immediate- long-term investment	**NGO's**- BCN, OSP, BNHS, WTI RSPB, TPF, WWF, WCS	Indications of species population trends, diclofenac sensitivity and exposure rates identified

	1.3f	Document NSAIDs Gyps vultures have been exposed to worldwide to identify relative sensitivity of Gyps to different drugs, identify suitable/unsuitable alternatives	Worldwide	★★★★	◇	Immediate- < 6 months	RSPB, NBPT- UK	Document listing outcome of exposure of Gyps vultures to different NSAIDs
	1.3g	Investigate residence times of diclofenac and other NSAIDs in livestock tissues	India	★★★★	◇◇	Immediate- < 1 year	BNHS, RSPB, University of Aberdeen, CSL	Predictive models for residence time and residue levels of diclofenac and other NSAIDs in major livestock species
Public awareness and training	1.4a	Public Awareness Campaign on harmful effects of Diclofenac	All Affected States	★★★★	◇◇-◇◇◇	Immediate- ongoing	NGO's- BCN, OSP, BNHS, WTI, RSPB, TPF, NBPT, WWF, WCS	Target Groups- Decision Makers, legislators, Veterinarians, Pharmacists, Drug Companies, Farmers, Cattle Shelters, Parsis, Jains, Vedas Voluntary change in diclofenac usage patterns

	1.4b	Campaign to promote alternative drugs	All Affected States	★★★★	◇◇-◇◇◇	To begin in 6 months – 1 year (once alternatives identified). Ongoing	**Government Agencies** (Indian Veterinary Research Institute) State and Central governments for India, Nepal, Pakistan and other range states Pharmaceutical companies **NGO's**- BCN, OSP, BNHS, WTI, RSPB, TPF, NBFT, WWF, WCS	**Target Groups-** Decision Makers, legislators, Veterinarians, Pharmacists, Drug Companies, Farmers, Cattle Shelters, Parsis, Jains, Media Diclofenac phased out of use Alternative drugs preferred by users
	1.4c	Education campaign for disposal of treated carcasses (preceded by pilot project?)	All Affected States	★★★	◇-◇◇◇	Depends on feasibility - ongoing	**NGO's**- BCN, OSP, BNHS, WTI, RSPB, TPF, NBFT, WWF, WCS	**Target Groups-** Farmers, Cattle Shelters Carcass disposal patterns changed
Policy and Legislation	2.1	Depends on results of research						
Species and Habitats	2.2	NONE						
Monitoring and Research	2.3a	To determine whether herpes virus is causing large scale vulture mortality	India, Pakistan, Nepal, USA, UK, Australia	★★★★	◇◇◇◇	Immediate- for one year	BNHS, ZSL, Poultry Diagnostic and Research Centre, Washington State University, Australian Animal Health Laboratory	Determination of pathology caused by virus Determination of geographical extent of virus
Public awareness and training	2.4	Depends on results of research						

Population Status	Policy and Legislation	3.1a	Reports to governments of all range states about the impacts of diclofenac on Gyps species	All range states	★★★★	◇	Immediate-short term investment	NGO's- BCN, OSP, BNHS, WTI, RSPB, TPF, NBPT, WCS, BirdLife International, WWF	Distribution of workshop recommendations and species recovery plan to government agencies in all range states
	Species and Habitats	3.2a	Collate database(s) with key areas with breeding Gyps Populations	All range states	★★★★	◇-◇◇◇	Immediate-short-term investment	BNHS, TPF, BirdLife International, RSPB, WCS	Collated information on Gyps populations available to the public either via scientific publications, reports or websites
		3.2b	Document numbers of captive Gyps in S.E. Asia	Cambodia Vietnam, Thailand Myanmar, Laos Bhutan, etc	★★★	◇	Short term investment	(BCN, BNHS, OBC, BirdLife International, Wildlife Trust of Bangladesh, Bhutan (Rebecca Pradhan?), WCS/ MAFF, RSPB, OSP, TPF)	Report of captive population across range states – information to be combined to summarise worldwide captive population
		3.2c	Develop network of country contacts/ representatives	All range states	★★★★	◇	Immediate – short term investment	BCN, BNHS, OBC, BirdLife International, Wildlife Trust of Bangladesh, Bhutan (Rebecca Pradhan?), WCS/ MAFF, RSPB, OSP, TPF	Working news group of organisations, key contacts across Gyps range states
	Monitoring and Research	3.3a	Determine Asian Gyps species distribution	All range states	★★★★	◇◇-◇◇◇◇	Immediate-< 2 years	BCN, BNHS, OBC, BirdLife International, Wildlife Trust of Bangladesh, Bhutan (Rebecca Pradhan?), WCS/ MAFF, RSPB OSP, TPF	Current distribution map of all three resident Gyps species in Asia – with information on sampling effort/ censused areas

South Asian vulture recovery plan

3.3b	Detect population trends over time	All range states, particular emphasis on Indian sub-continent	★★★★	◊◊◊	Immediate - ongoing	BCN, BNHS, OBC, BirdLife International, Wildlife Trust of Bangladesh, Bhutan (Rebecca Pradhan?), WCS/ MAFF, RSPB OSP, TPF	Population databases showing temporal trends in Asian *Gyps* populations
3.3c	Document breeding numbers at key sites	All range states	★★★	◊◊◊	Immediate-ongoing	BCN, BNHS, OBC, BirdLife International, Wildlife Trust of Bangladesh, Bhutan (Rebecca Pradhan?), WCS/ MAFF, RSPB, OSP, TPF	Database indicating breeding numbers and reproductive success at key locations
3.3d	Initiate *Gyps fulvus* and *G. himalayensis* monitoring in South Asia	India, Nepal, Pakistan	★★★★	◊-◊◊◊	Immediate-ongoing	BNHS, RSPB, BCN	Baseline indices of resident and migratory population abundances of *G. fulvus* and *G. himalayensis*
3.3e	Initiate monitoring of other non-*Gyps* scavenging species in South Asia	All range states	★★★★	◊◊-◊◊◊	Immediate-ongoing	BCN, BNHS, OBC, BirdLife International, Wildlife Trust of Bangladesh, WCS/ MAFF, RSPB, OSP, TPF	Indices of abundance for scavenging species – estimated using standardised monitoring techniques
3.3f	Investigate the ecological consequences of increases in mammalian and other non-*Gyps* scavengers	All range states	★★★	◊◊◊	Medium-term investment	BCN, BNHS, OBC, BirdLife International, WCS/ MAFF, RSPB, OSP, TPF	Report on changes in numbers/ abundance of mammalian scavengers and concurrent changes in species abundance of target groups. Measures/ indicators of increases in disease/pathogens prevalence

		3.3g	Institute standardised monitoring techniques	All range states	★★★	◇	Immediate-short term investment	All involved research organisations	Set of simple guidelines for monitoring scavenging species- distributed to all relevant field-workers
		3.3h	Evaluate threats to human health caused by reduced numbers of scavengers (e.g. water quality bacterial contamination of soil, fly borne disease incidence)	All states with reduced vulture numbers	★★	◇	Intermediate to long-term study	Involved research organisations, universities and public health organisations	Report on changes in incidence of infectious diseases, reports on risks or threats to ground water safety from carcasses
	Public awareness and training	3.4a	Education/awareness campaign about diclofenac	All range states	★★★★	◇◇◇-◇◇◇	Immediate-ongoing	NGO's- BCN, OSP, BNHS, WTI, RSPB, TPF, WWF, NBPT, WCS	Distributed educational material
Future Threats	Policy and Legislation	4.1a	Ensure long-term protection for *Gyps* nesting sites	All range states	★★★	◇◇-◇◇◇◇	Long-term investment	NGO's- BCN, OSP, BNHS, WTI, RSPB, TPF, WWF, NBPT, WCS	Persistence of necessary habitat where *Gyps* species have historically nested
		4.1b	Require government bodies/infrastructure companies to report on vulture mortalities	All range states	★★	Unknown	Ongoing	India Railways, State owned electricity companies Transport/Highways department Wildlife departments	Centralised recording network of vulture mortalities
	Species and Habitats	4.2a	Establish central database of poisoning incidents and vulture mortalities	All range states	★★	Unknown	Ongoing	Central government; BNHS?	Accessible central database of vulture mortality incidents and causes

	4.2c	Control disposal of carcasses containing lead shot	All range states	★★★	◊◊-◊◊◊	Before reintroduction programme begins	State and Central governments for India, Nepal, Pakistan and other range states	Removal of lead contaminated carcasses from vulture habitat
	4.2c	Assess changes in food availability and changes in carcass disposal affecting food availability	All range states	★★	◊◊	Ongoing	NGO's- WCS, BCN, CSP, BNHS, WTI, RSPB, TPF, WWF, NSPT	Report on temporal trend in carcass availability and numbers of attendant scavengers
	4.4d	Establish vulture restaurants to provide safe food/augment available food supplies	All range states	★★★★	◊◊-◊◊◊	Immediate-ongoing	NGO's- WCS, BCN, OSP, BNHS WTI, RSPB, TPF, WWF **Governmental Organistations-** State and Central Governments, WII	Establishment of vulture restaurants near breeding/ roosting colonies with regular supplies of 'clean' meat
Monitoring and Research	4.3a	Monitor levels/prevalence of known environmental contaminants that might affect vulture release/recovery	All range states	★★★	◊◊-◊◊◊	Before reintroduction programme begins	**NGO's-** BCN, CSP, BNHS, WTI, RSPB, TPF, WWF **Governmental Organistations-** State and Central Governments, WII	Statistics documenting the extent of environmental contaminants in vulture habitats
	4.3b	Determine nesting characteristics, habitat requirements general species natural history of all Gyps species	India, Nepal Pakistan	★★★	◊-◊◊◊	Immediate-mid-term investment	BNHS	Report/ publication of natural history characteristics of the three Asian Gyps species
	4.3c	Monitor trade in vultures for medicinal trade	All range states	★★	◊	Ongoing	WTI, BNHS, WCS	Regular reports about trafficking in vultures (parts)
Public awareness and training	4.4a	Awareness campaigns about the dangers of kite flying to vultures/other birds (identify solutions)	India- other affected states?	★★	◊-◊◊	Immediate-ongoing	?	Distributed educational material

	4.2c	Control disposal of carcasses containing lead shot	All range states	★★★	◇◇-◇◇◇	Before reintroduction programme begins	State and Central governments for India, Nepal, Pakistan and other range states	Removal of lead contaminated carcasses from vulture habitat
	4.2c	Assess changes in food availability and changes in carcass disposal affecting food availability	All range states	★★	◇◇	Ongoing	NGO's- WCS, BCN, CSP, BNHS, WTI, RSPB, TPF, WWF, NBFT	Report on temporal trends in carcass availability and numbers of attendant scavengers
	4.4d	Establish vulture restaurants to provide safe food/augment available food supplies	All range states	★★★★	◇◇-◇◇◇	Immediate-ongoing	NGO's- WCS, BCN, CSP, BNHS, WTI, RSPB, TPF, WWF **Governmental Organistations-** State and Central Governments, WII	Establishment of vulture restaurants near breeding/roosting colonies with regular supplies of 'clean' meat
Monitoring and Research	4.3a	Monitor levels/prevalence of known environmental contaminants that might affect vulture release/recovery	All range states	★★★	◇◇-◇◇◇	Before reintroduction programme begins	NGO's- BCN, CSP, BNHS, WTI, RSPB, TPF, WWF **Governmental Organistations-** State and Central Governments, WII	Statistics documenting the extent of environmental contaminants in vulture habitats
	4.3b	Determine nesting characteristics, habitat requirements, general species natural history of all Gyps species	India, Nepal, Pakistan	★★★	◇-◇◇◇	Immediate-mid-term investment	BNHS	Report/ publication of natural history characteristics of the three Asian Gyps species
	4.3c	Monitor trade in vultures for medicinal trade	All range states	★★	◇	Ongoing	WTI, BNHS, WCS	Regular reports about trafficking in vultures (parts)
Public awareness and training	4.4a	Awareness campaigns about the dangers of kite flying to vultures/other birds (identify solutions)	India- other affected states?	★★	◇-◇◇	Immediate-ongoing	?	Distributed educational material

		4.4b	Education/ Awareness campaigns about the impact of carcass poisoning on non-target species	All affected states	★★	◊-◊◊◊	Ongoing	Local NGO's?	Distributed educational material
		4.4c	Education/ awareness campaigns to reduce direct and indirect persecution of vultures	All range states	★★	◊-◊◊◊	Ongoing	BNHS WTI BCN, OSP, WCS, WWF	Distributed educational material

List of range States: India, Nepal, Pakistan, Bangladesh, Bhutan, Myanmar, Cambodia, and Laos

Importance ★ - low priority ★★ medium priority ★★★ -medium-high priority ★★★★ - high priority/ critically important

Costs ◊ < £5,000, ◊◊ £5,000-15,000 ◊◊◊ £15,000- 25,000, ◊◊◊◊ >£25,000

8 CAPTIVE BREEDING

8.1 Justification

Given the many practical obstacles to the immediate removal of the current threats to Asian *Gyps* vultures from the environment and the continuing rapid declines of vulture populations, it is likely that some or all species will soon become extinct in the wild either completely or over large parts of their range. Therefore, workshop participants agreed that captive holding and breeding until diclofenac is controlled is the most plausible way to ensure the long-term survival of these species. The following section outlines the purpose and considerations necessary before embarking on a captive breeding programme and is illustrated with examples from other raptor conservation breeding programmes.

8.2 Introduction

Captive populations can serve several conservation and education goals. In terms of conservation use, they can be held as a genetic reservoir against loss of genetic diversity in the wild, used to establish new wild populations or augment existing populations, or used to provide animals for research to promote conservation of wild populations. In terms of educational use, captive populations can increase public awareness of conservation issues, enhance fund-raising efforts for *in situ* conservation efforts, and provide appreciation of biodiversity through education and recreation.

8.2.1 Captive population options

Given the current conservation status of *Gyps* vultures in South Asia, the immediate objective of a captive population will be to provide a 'life-boat' as most of the wild populations will likely soon become extinct. Vultures have been showed to adapt readily to captivity, which indicates a high probability of successfully managing a captive population. These vultures can form the core of a captive breeding and reintroduction programme as discussed below. Captive populations will also permit further research into the causes of the declines. Birds that are later reintroduced can be continually monitored so that cause of death can be immediately identified.

There are several strategies for acquiring and managing captive populations in order to recreate or augment wild populations. The first option involves translocation and release, in which birds are collected from the wild and trans-located for release into the area in which the species has been lost or depleted with no captive breeding and only a short time in captivity. This approach requires the existence of a large and stable population of the species remaining in the wild which can tolerate removal of the necessary numbers of birds and the existence at the same time of suitable recipient areas from which threats have been removed. Based on what we know of Asian vulture populations, this situation does not exist for *Gyps tenuirostris* and *Gyps bengalensis* and probably not for *Gyps indicus.* This method therefore cannot be used to restore Asian vultures.

The second option involves capture, holding, and release. It does not involve captive breeding, but may require a long period of maintaining wild-caught birds in captivity. It requires the capture of a large number of birds and good captive care conditions so that sufficient birds remain in good condition when release to the wild becomes possible. This may take a long time in the case of removing the threat from diclofenac from the environment. Given the good survival rates of vultures in well-maintained captive care facilities, this option appears at first to be practical. It has the advantage that birds released to the wild, if at least some of them are captured when free-flying, will have experience of conditions in the wild and may be better equipped to avoid predators and find resources than naïve birds captured as nestlings or bred in captivity. However, there are several severe disadvantages to relying on this approach as the sole method. Hundreds of vultures of each species would have to be captured from the wild to have sufficient stock to make releases of sufficient birds at several sites ten or more years later. Vulture populations may already be too small for this option to be practical, at least in the case of *Gyps tenuirostris*. At present rates of decline it will also be difficult or impossible to achieve for *Gyps bengalensis* within a year or two, even if it not already too late. Another fundamental problem is that the consequences of an error in the decision that conditions are safe enough to permit birds to be released back to the wild will probably be dire. If the environment turns out still to be unsafe then, unless the released birds can be recaptured quickly, the stock of birds will be lost and there may be too few left for further releases.

The third option is captive breeding and release. Existing stocks of captive birds of all three species are insufficient for the establishment of a viable captive population, so this would first require the capture of birds from the wild. A simple deterministic model of a captive vulture population and the wild population eventually derived from it indicates that a breeding centre with 25 pairs would be capable of producing a derived wild population of 100 pairs about 10 years after the beginning of releases. Releases would not begin until a minimum of 6 years had elapsed since the capture of the founding stocks (assuming that most of the founders are taken as nestlings or juveniles). To allow for mortality in captivity and unequal numbers of the sexes taken from the wild, it would be necessary to take about 60 birds of each species from the wild to initiate a centre which would eventually lead to the restoration of a single wild population of 100 pairs 16 or more years later. A similar model for the captive holding and release option (i.e. without captive breeding) indicates that about twice as many birds would be have to be taken from the wild to achieve the same outcome. It should also be noted that if the decision to begin releases is incorrect, because the environment is still unsafe, the captive breeding and release option allows the release programme to be suspended and diverted to a new area. A preliminary evaluation of the proposed captive breeding and release programme indicates that it would preserve a high proportion of the original genetic diversity of the vulture population.

There are a number of general considerations that must be addressed before the establishment of captive populations and subsequent reintroduction of species: It is imperative that captive populations are established before source populations have declined to such levels that extinction is imminent. Captive breeding and subsequent reintroduction is a long-term, expensive undertaking and careful assessment of the personal and financial investment available should be taken before a captive breeding programme is initiated. As vultures reproduce slowly, the establishment of adequate numbers of birds to release will take a considerable amount of time, necessitating commitment in terms of decades rather than years. There should be adequate facilities, expertise, and funding available before large captive populations are established to ensure proper treatment of captive animals. It is important to establish several sites in case individuals in one captive population are lost due to disease or other potential disaster.

IUCN guidelines for managing *ex situ* populations can be found at: http://www.iucn.org/themes/ssc/pubs/policy/exsituen.htm

8.2.2 Future reintroduction of gyps

It is necessary to know what factors are causing mortality in wild populations, both before captive populations are established and when individuals are released back into the wild. Monitoring behaviour and survival of released individuals can help identify the causes of mortality and document the success of reintroduction programmes. Satellite/GPS transmitters, as well as conventional radio-telemetry, can be used to track the movements of released birds and identify hazards or risks that the birds are exposed to. Tracking can also help locate birds that have died after release to post-mortem investigations can identify the cause of death.

Captive raised individuals of many species have proven to be naïve to predators and measure need to be taken to minimise the likelihood of maladaptive or naïve behaviours. Vultures do not appear to be particularly prone to behavioural naïveté when released, but rehabilitation procedures should be carefully considered. To help avoid the loss of empirical field knowledge, it would be desirable to take into captivity some free-flying sub-adult birds that could be released with captive bred juveniles to provide that knowledge base. Otherwise, mortality of released juveniles can be expected to be higher than normal as they “learn” about their new, hazardous environment. Releases of young should occur in groups of >10 birds at three sites for 5-10 years, with constant monitoring, and releases then move on to the next site.

IUCN guidelines for reintroduction programmes can be found at: http://www.iucn.org/themes/ssc/policy/reinte.htm

8. 3 Workshop recommendations

8.3.1 Scope of captive breeding activities

After evaluating the various captive management options, the workshop concluded that captive management of all three vulture species was necessary and that there was a particularly urgent requirement to begin programmes immediately for *G. tenuirostris* and *G. bengalensis*. *G. tenuirostris* is the rarest and least well

known of the three resident *Gyps* species, while *G. bengalensis* appears to be undergoing the most rapid rates of population declines. The participants at the meeting agreed that a minimum of 60 birds to establish 25 pairs of each the three species should be brought into each breeding centre and that populations of each species should be held at least three centres. Ideally more centres should be established as the second aim of the plan is to establish six populations of each species and each captive population can provide enough birds for one sustainable wild population (section 7.2) Thus, if these captive flocks are replicated at six facilities then a minimum of 360 birds of each species must be collected. The suggested age-structure of the founding population should be 70-85% known-age nestlings, 10-15% sub-adults, rest adults so that most of the captive population are of known-age and are most likely to breed (R. Watson pers. comm.).

8.3.2 Technical advisory committee

A key recommendation is the creation of a technical advisory committee (TACVCM) for captive breeding that is composed of national stakeholders and international conservation breeding experts from relevant organisations such as the IUCN CBSG and RSG, TPF, ZSL, NBPT, WCS, ERWDA, BNHS and technical members from range state organisations. Each holding and/or breeding centre should be visited annually by individuals from at least two TACVCM member organisations from countries outside the facility. These member organisations should report annually to the recovery plan secretariat (see below) at the annual plan review meeting on the progress, development and requirements of individual facilities. This committee ideally will nest as a subgroup within the international vulture task force (section 7.4).

8.4 Existing and planned centres

The general facilities needed for holding and breeding captive populations of vultures are aviaries, incubators, brooding chambers, and food production/ storage facilities. As some raptor species are easier to breed than vultures are likely to be, it may be possible to use other species, such as kestrels to allow the staff to gain experience handling eggs, hatchlings, and young birds.

Pinjore Centre

The Bombay Natural History Society and the Haryana State Government, with financial support from the Darwin Initiative, UK, have already constructed a vulture care centre in Pinjore, Haryana. There are holding, hospital, and small flight aviaries that are currently holding 30 *Gyps* vultures, fifteen are *G. bengalensis*, and fifteen are *G. indicus*. There is potential to adapt these enclosures to make them suitable for breeding and to build two additional large flight aviaries. After enlargement, the centre should have the capacity to hold 15-20 pairs of each of the three endangered species. The centre represents a successful collaboration between government and national NGOs and should serve as a model for the construction of future centres.

Proposed Centres for Captive Management and Conservation Breeding

Country with Vulture Population	Location (proposed)	Species	Proposed Action	Management/ Stakeholders	Costs		Institutional Commitment		Limiting factors
					1st year (available/ needed)	Recurring costs	Organisation	Priority	
India	Pinjore, Haryana	OWBV, LBV, SBV (?)	Expansion of current facilities to house 25 pairs of all three species	Haryana State Government, BNHS, RSPB, IcZ, NBPT, WCS	£40,000 extension (£40,000/ 0)	£20,000	Darwin Initiative, RSPB, NBPT-UK, ZSL	High	No slender-billed vultures
	Seorh, Haryana (2)	OWBV, LBV, SBV (?)	Construction of facility to house 75 pairs of vultures (3 species x 25 pairs)	Haryana State Government, BNHS, RSPB, ZSL, NBPT, WCS			ZSL, NBPT, State Govt	?	Funds
	Mastpur, Himachal Pradesh	OWBV, SBV	Construction of facility to house 50 pairs of vultures (2 species x 25 pairs)	Himachal Pradesh Government, BNHS, (WCS)	Appx. £100,000	£20,000	RSPB?, State govt.	?	Acquisition of permits for construction and catching birds, funding
	Assam	OWBV, SBV	Construction of facility to house 25-50pairs two species. Slender-billed vultures highest priority	Government of Assam, BNHS (WCS, RSPB)	Appx. £100,000	£20,000	ZSL, WCS RSPB	?	Acquisition of permits for construction and catching birds, funding
	West Bengal	OWBV, LBV, SBV	Construction of facility to house 75 pairs of vultures (3 species x 25 pairs)	Government of West Bengal, BNHS, RSPB			RSPB	?	Acquisition of permits for construction and catching birds, funding
	Other Indian States-Punjab, Madhya Pradesh, Gujarat, Rajasthan, Maharastra, Uttar Pradesh	OWBV, LBV, SBV	Proposed additional holding/breeding centres	State Governments BNHS Central Government, RSPB, (WCS, WWF-India)	Appx. £100,000/ centre	£20,000		?	Collaborative agreements, acquisition of permits for construction and catching birds, funding

Nepal	(Chitwan National Park)	OWBV, SBV	Construction of Centre to house 25 pairs of slender-billed and 25 pairs of white-backed vultures	BCN, KMT, Government of Nepal, ZSL	Appx. £100,000 (£72,000-£28,000)	£20,000	Darwin Initiative-BCN RSPB, KMT, ZSL	?	Acquisition of land for centre Political stability
Pakistan	Abu Dhabi	OWBV, LBV	Translocation of 25 pairs of birds of white-backed and long-billed vultures to Abu Dhabi ERWDA centre	TPF, Government of Pakistan, ERWDA	?	£20,000	TPF, ERWDA	?	Collaborative agreements, permits, funding, infrastructure expertise

Species code: OWBV- Oriental white-backed vulture, LBV- long-billed vulture, SBV -

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APPENDIX A – MANIFESTO

Agreed by Bird Conservation Nepal, BirdLife International, Bombay Natural History Society, Ornithological Society of Pakistan, RSPB, The Peregrine Fund, Zoological Society of London.

Three species of *Gyps* vultures (*G. bengalensis, G. tenuirostris, G. indicus*) have declined at an alarming rate across India, Pakistan and Nepal in the last decade. In survey areas numbers have declined by more than 95% of former levels. Declines are well documented from survey data published in the peer-reviewed literature. In 2000, *G. bengalensis* and *G. indicus* (recently split into *G. indicus* and *G. tenuirostris*) were listed by IUCN as Critically Endangered, which is their highest category of endangerment and indicates that there is a high risk that they will become extinct in the near future. Current evidence suggests that populations of these species continue to fall very rapidly.

Recent scientific evidence indicates that diclofenac (a non-steroidal anti-inflammatory drug) is a major cause of the observed vulture declines.

Exposure of vultures to diclofenac arises through its veterinary use to treat domestic livestock. Experiments show that vultures are highly susceptible to diclofenac and are killed by feeding on the carcass of an animal soon after it has been treated with the normal veterinary dose.

Modelling shows that only a very small proportion of livestock carcasses need to contain a level of diclofenac lethal to vultures to result in vulture population declines at the observed rates.

Whilst other factors may influence *Gyps* populations, there is currently no conclusive evidence that any other cause is involved. We believe that recovery from the declines will be possible only if exposure of wild vultures to diclofenac is prevented.

Evidence suggests that extinction of the three *Gyps* vulture species is imminent. Current captive populations are not viable, so immediate action is needed to obtain, hold, and possibly breed, these species in captivity, until sources of diclofenac exposure have been effectively removed from the vultures' environment. It is possible that wild stocks of some of the threatened vulture species will be insufficient for the establishment of a viable captive population if this recommendation is not acted upon in 2004.

Vultures are keystone species and their declines are having adverse effects upon other wildlife, domestic animals and humans. In particular, there is a risk of increases in diseases that threaten human life and welfare.

Halting and reversing the vulture declines is one of the most urgent conservation priorities worldwide. Resolution of this problem requires considerable commitment by governments and the pharmaceutical industry.

We call upon governments of all *Gyps* vulture range states in Asia, Africa, Europe and the Middle East, and manufacturers of diclofenac, to ban the use of this drug for veterinary medicine, throughout the range or former range of *Gyps* vultures. The need for this action is especially urgent in the main range states of the three currently threatened species, namely Bangladesh, Bhutan, Cambodia, India, Myanmar, Nepal and Pakistan.

Very small relict and declining populations of *G. bengalensis* and *G. indicus* exist in Southeast Asia, particularly Cambodia, and are thought not to be exposed to diclofenac. High priority should be given to improving the status of these populations.

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Annexe B – Stakeholders

Organisation and address	Functions	Contact Name(s) And Title
Government of India	Granting permission for conservation and research activities. Recommendations for action/policy to state and central government officials	Mr. Bist, Inspector General of Forests Mr. Srivastava, Deputy Inspector General of Forests
Government of Haryana	Administration, monitoring, law enforcement, captive breeding, managing government NGO relationships, acquiring state and central government permission for conservation programmes	Mr. Jakati, Chief Conservator of Forests, (Wildlife)
Himachal Pradesh Forest Department, Talland, Shimla 171002 Email cefhqrs@sancharnet.in Phone 0177 – 2624193	Expertise – Administration – Monitoring – Law enforcement - Working with rural communities - International work Captive breeding Conservation	K. Gulati, IFS Additional Principal Chief Conservator of Forests and Chief Wildlife Warden Himachal Pradesh Lalit Mohan, Conservator of Forests
Assam State Government	Law enforcement, monitoring, education, research	M. C. Malakar Chief Wildlife Warden A. Choudhry
State Government of Maharastra		Mr. Majumdar, CCF (Wildlife)
Madhya Pradesh Government		A.P. Diwedi, PCCF
Indian Institute of Veterinary Sciences	Research, responsible for policy recommendations to central government	M.P. Singh, Director
Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun	Education and training Monitoring and Research	Dr Anil Kumar
Zoological Survey of India, Solan (H.P.)	Monitoring, Campaigning, Law enforcement	Romesh Kumar Sharma
BNHS / C B Patel Research Centre, Mumbai	[Physiology, Pharmacology, Analytical chemistry] Research	A.M. Bhagwat,
Bombay Natural History Society	Research, monitoring, captive breeding, centre development, training	Asad Rahmani, Director Dr. Rachel Reuben, Hon. Secretary Vibhu Prakash, Principal Scientist Rishad Navroji, Executive Committee Member Udayan Borthakur, Research Fellow Devojit Das, Veterinarian Sachin Ranade Research Fellow S. Saravanan Research Fellow

IUCN Conservation Breeding Specialist Group	CBSG in general Conservation planning facilitation. Population risk analysis (population viability analysis/population and habitat viability assessment), disease risk assessment.	Kathy Traylor - Holzer, Program Officer
Forest Department Gujarat State, DCF, Wild Life Training, Gujarat Forest Research Institute, 'J' Road, Near Akshardham, Gandhinagar 382020	Individually Training - Campaigning - Education Research (excluding laboratory work, mainly surveys) Monitoring As an organisation Most aspects are agreed by the Govt.	Uday Vora, Deputy Conservator of Forests
RSPB	International conservation research, capacity building and, programme management and support, training, funding, centre development	Chris Bowden RSPB Vulture Programme Manager Deborah Pain, Head of International Research Rhys Green, Principal Biologist Susanne Shultz, Research Biologist Steven Parr, Country Programme Officer
Bird Conservation Nepal	Monitoring, research, education, captive breeding, work with rural communities	Hem Sagar Baral Ishana Thapa
Institute of Zoology, Zoological Society of London		Andrew Cunningham, Head of Wildlife Epidemiology Nick Lindsay- International Zoo Programmes
WWF India	Campaigning, International Work, Education, Monitoring	Prakash Rao
Assam Forest Department	Areas where I can involve myself - Law enforcement Monitoring - Education	M. C. Malakar Chief Wildlife Warden
Glasgow University	Research, use of captive breeding and reintroduction programmes	Professor David Houston
Sundarban Tiger Reserve	Law enforcement Work with rural communities Monitoring	Pradeep Vyas, Conservator of forests and field director
National Birds of Prey Trust	Captive breeding, education, captive research, training, international work, organisational skills, computer skills	Jemima Parry-Jones
(KERALA) BNHS	Monitoring – Research – Campaigning	C. Sashikumar
Nature Conservation Society of Nashik	Monitoring – campaigning – work with rural communities - education	Bishwarup Raha
Science Office, U.S. Embassy, Delhi		Priya Ghosh
Director (Wildlife) State of Punjab		Mr. Gurmit Singh

Pigmy Hog Conservation Programme	Captive breeding in India	Goutam Narayan, Director
IUCN Reintroduction Specialist Group	RSG - reintroduction programme advice, training, facilitation	Pratap Singh Sooraé, Programme Officer
WCS Cambodia Programme, Ministry of Agriculture, Forestry, and Fisheries, Cambodia	Research, project management	Tan Setha
WCS Cambodia	Research, project management	Colin Poole, Director Tom Clements, Programme Officer
The Peregrine Fund	International research, monitoring, captive breeding, training, programme support	Rick Watson, Director of International Programmes Martin Gilbert Munir Virani
Washington State University	Research	Lindsay Oaks
Wildlife Trust of India	Advocacy	V. Phana?
Bhutan	Monitoring, research,	Rebecca Pradhan
SACON	Research	V.S. Vijayan, Director
Wildlife Trust of Bangladesh	Research, monitoring	Anwarul Islam, Chief Executive
Ornithological Society of Pakistan	Research, monitoring, advocacy, government liaison	Aleem Ahmed Khan, Director
BCN	Research, monitoring, advocacy, captive breeding	Hem Sagar Baral
Oriental Bird Club	Financial support for research activities in region	
Bodega Bay Institute	Advocacy, campaigning	Robert Risebrough
U.S. Fish and Wildlife Service	Expertise in international conservation and research programmes in India.	Dave Ferguson
PDRC	Avian research	Dr. Ghalsashi
BirdLife South East Asia	Research, strategic planning, advocacy	Jonathan Eames
Wildlife Conservation Society, New York	Research, captive management, fundraising, training	Nancy Clum
Israel Nature & Parks Authority	Captive management, population monitoring, satellite tracking	Ohad Hatzofe
American Zoological Society, Raptor TAG (Taxon advisory group)	Captive management and breeding, ex situ conservation, education, advocacy	Stan Searles
Disney Foundation	Fundraising, education, captive management	Scott Tidmus